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# GAS JOURNAL

LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLIII. No. 3011.] LONDON, JANUARY 26, 1921. [73RD YEAR. PRICE 1s.



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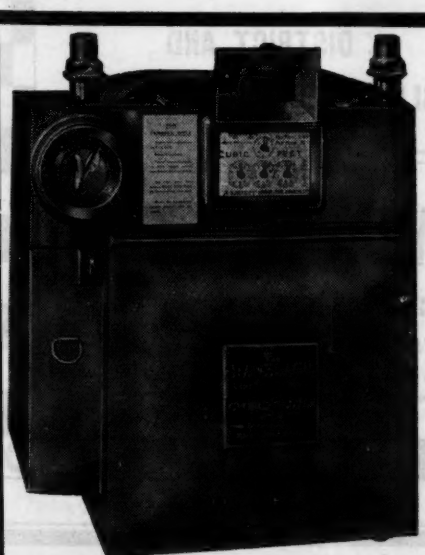

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLIII., No. 3011.] WEDNESDAY, JANUARY 26, 1921. [73RD YEAR.


## EDITORIAL NOTES.

### The Increase and the Slump.

MUCH public attention was drawn last week-end to the announcement that the Board of the Gas Light and Coke Company had resolved to increase the price of gas by 10d. per 1000 c.ft.—raising it from 4s. 8d. to 5s. 6d. It is stated in the newspapers that the decision had come as a great surprise to the public; but perhaps the public will have gathered from the full and frank statement the Company issued regarding the matter, that the necessity for making such an increase had been somewhat of a surprise to the Directors. In fact, there is good ground for sympathizing with them rather than adversely criticizing their action. The resolution to take this long step in increasing the price was forced upon the Board by the sudden long backward stride taken by revenue producing circumstances over which they have no influence whatever. The price of gas in the Company's area has been 4s. 8d. per 1000 c.ft. for some fifteen months, despite the higher costs for coal, oil, maintenance, and wages; and it was only kept in this position by the heavy income which the Company derived from their secondary products—principally from coke sold to the Continent from the Beckton works—as well as by the fact that the stockholders have only been allowed, under the Statutory Undertakings (Temporary Increase of Charges) Act, to receive a dividend of 3 p.ct. Receipts from bye-products during 1920 amounted to no less than £4,800,000 compared with £1,250,000 in 1913; while the dividend for last year required a sum £360,000 less than for the year 1913, when the price of gas was 2s. 6d. All the benefit of these two conditions is represented in the lowness of the 4s. 8d. charge for the past fifteen months—"lowness," of course, in relation to the high costs of materials and wages which have to be paid in order to render the service. The consumers ought to be gratified that in the circumstances they have so long enjoyed this low price. Even now the increase of revenue that the higher price of gas will yield will not by any means meet the decrease in revenue for the current year; but the Directors—who naturally were very reluctant to take the step they have done, but need was an overpowering force—were anxious to allow hopes for somewhat better conditions in regard to coal and oil costs to enter into their calculations as to the prospective position.

Consumers have enjoyed the benefit of these exceptional conditions; but the harvest of revenue from the export of coke has come to an abrupt end. The Directors of the Company never, of course, expected that the high prices for exported coke would continue for ever. What they did expect was—not that there would be a sudden break in the position, but that the prices of coke for export would decline in something like a regular gradation, and so ease the situation in regard to revenue. Some of the daily papers have pointed out to the public that the Gas Light and Coke Company alone among the Metropolitan and Suburban Companies have given notice of an increase in price. This is true for the moment; but let us examine the progress in regard to movements in prices during the war and since. The calorific value of the Company's gas has fallen by a small percentage; but that is the position with all other Companies except the South Metropolitan, whose advance of 122 p.ct. in the price of gas is not therefore comparable. When, however, we measure the increase of the charges in terms of percentages in regard to the other London Companies, it will be seen that during recent times the Gas Light Company have moved forward less rapidly than any of them. With a pre-war price of 2s. 6d. and a charge up to now of 4s. 8d., the increase has been 87 p.ct. The Commercial Company's charge before the war was 2s. 4d.; it is now 4s. 8d.—an increase of 100 p.ct. The Brentford Company's pre-war price was 2s. 4d.; it is now 5s. 4d.—an increase of 129 p.c. The Croydon Company's price before the war was 2s. 5d.; it is now 5s. 3d.—an increase of 117 p.ct. The South Suburban Company's charge prior to the war was 2s. 3d.; it is now 5s. 5d.—an increase of 141 p.ct. The Tottenham Company's price before the war was 2s.; it is now 5s. 1d.—an increase of 154 p.c. The Wandsworth Gas Company's price was 1s. 9d; it is now 4s. 2d.—an increase of 138 p.ct. So taking into account the difference in the pre-war conditions of the Companies, the Gas Light 87 p.ct. increase has been low; and the 5s. 6d. now to be charged will only represent 120 p.ct. on the pre-war price, which is still less than the percentage increases of some of the Companies. We merely point this out in fairness to the Gas Light and Coke Company, because of the misconception of the position which has been seen in certain newspapers. Considering that the price of coal has risen 200 p.ct., and oil has gone up from 2d. to 1s. 3½d. per gallon, the 120 p.ct. increase in the price is very modest; and the relative percentage increases of other companies would suggest that the Gas Light and Coke Company have been selling gas at too low a price—to the advantage of the consumers.

Although other companies in, and on the borders of, London have not yet signified an intention of raising their prices, no one knows how soon those among them who have enjoyed a large revenue from exported coke will have to follow the Gas Light Company and some of the gas undertakings on the north-east coast, and balance the revenue lost in this direction by additions to the price of gas. Moreover, the industrial position at home has caused a falling-off in the demand for other secondary products, as well as a lowering of the general home demand for coke; and the influence of this will be felt more or less throughout the gas industry. The suddenness with which the present position has matured is shown by the fact that the unusual course of making the increase during a quarter and having a special reading of the meters for the purpose, has been decided upon by the Directors of the Company.

The reasons for the great slump in the price of export coke, which has so enormously upset the calculations of those gas undertakings whose consumers have been the beneficiaries of the exceptional position, are not far to seek. They are traceable to the coal strike, which had been talked about for months before it actually occurred. Everybody on the Continent "got the wind up." Coal was bought from all quarters—from America and even farther afield; and coke made in this country fetched, for Continental use, as high as £10 or more per ton. Then the strike lasted only two-and-a-half weeks instead of two months, as some people thought likely, but which mistake also stimulated demand for coke at high prices. Taken on the whole the winter has been mild, industry has been depressed, and the general disposition has been to economize in goods for which high prices have been paid. Now the Continent is overstocked with fuel; and the aggregate of adverse conditions has knocked the bottom out of the market. That is the position, and the main cause of the extent of the increase in the price of gas in North London.

Some people are asking as to the prospect of reductions

in the price of gas. No one can say anything definite about this at present. It will depend more upon the prices of coal and oil than upon anything else. It is to them that the gas industry are anxiously looking. The economic benefits to be derived from the Gas Regulation Act can only come gradually. There can be no revolutionary change. Coal and oil are the dominating factors, together with secondary products, in the gas industry's situation to-day.

## The Therm Basis and Power Supply.

No man has preached the gospel of a lower calorific power gas per cubic foot with more consistency and purpose, for over thirty years or more, than Sir Dugald Clerk. It must therefore be a matter of great gratification to him that, in the years of his professional activities, he has seen the fetters knocked off that bound the gas industry to old standards, and in their place a liberty brought into statutory being which gives the industry the opportunity of achieving the end of which he has been so staunch an advocate. Sir Dugald was far-seeing, as his papers and addresses, some of which date far back, so vividly show. Long before most other men, he saw the opportunities that the changed circumstances of the industry conferred upon it; and his sight was aided by his intimate knowledge of motive power requirements. It has, however, been a slow journey even to an approach to the goal. We are not at the goal yet; but the road is open to it.

Sir Dugald this week contributes valuable suggestions to our series of special articles in treating—it is his own subject—of "The Heat-Unit Basis in Relation to Power "Supply." This is a field in which very active work is needed if the gas industry is to make substantial progress in it. It has several competitors there—steam, producer gas, waste gases, electricity, and oil. Hitherto town gas has been working in this field under conditions that have imposed limitations, which have restricted in the higher region the unit motive powers that it could economically supply, and have also kept too high the price at which it, generally speaking, could afford to supply heat units for power purposes. Nevertheless it has not done badly in this line owing to inherent advantages. But the transfer of the industry to the therm basis and to the conditions attached to it—such as the declaration of the calorific value per cubic foot which an undertaking can most economically supply—has changed these limitations, and has given a freedom in the adoption and varying application of new gas-making processes which will prove to be of inestimable value in the competition for power, and will largely increase the industry's competitive range. The article by Sir Dugald points to two main directions in which the industry has to operate if it desires to occupy a more extensive place in the power field; and it must not now miss any of its opportunities. These two directions are: The reduction of cost per therm for power purposes, and (where conditions favour) the attacking of the problem of a second supply of a lower grade gas for capturing the higher motive power units.

Taking the question of price first. It has to be considered in relation to the costs of the competitors, though the advantages that gas possesses over solid fuel and oil in the matter of storage away from the manufacturers' premises, and delivery as and when required with a reliability that cannot be claimed by electricity, are contributors of considerable worth to economy and efficiency. In his Presidential Address to the Institution of Gas Engineers last June, Sir Dugald put a monetary value on the price per therm for motive power. The price he then gave was 5d. per therm. In other words, in his opinion the cost per therm as sold in the form of gas should not exceed three to four times the original cost per therm in the shape of coal. He accentuates this in the closing words of the present article when he says: "It is true that the cost of coal has "risen seriously; and so the cost of gas per therm must "be greater than the pre-war figures which I have given. "The advantages of gas for motive power are so great that "in even large engines the price per therm may be three "to four times that of coal per therm, while leaving gas "with some cost advantage over coal." This gives the industry a goal for which to work in the matter of price in operating for new business upwards from the lower power business, which it is able to retain at even five to six times the coal cost per therm, owing to the collateral advantages possessed by a power agent being obtainable by the user by the mere turning of a tap. But it will be for the industry to determine under the heat-unit basis the minimum commercial price at which therms can be sold for power purposes. Some gas undertakings can show a power price even to-day which works out to a relatively low figure per therm. Sir Dugald quotes the Greenock 7d. And this reminds us that nowadays gas undertakings when in Parliament almost invariably insert a clause in their Bills giving them the right to make differential charges for gas used for different purposes, but which charges, being lower than the ordinary ones, are not taken into account in calculating dividends under the sliding-scale. Practice has demonstrated that, by reducing the calorific power per cubic foot, more therms can be made per ton of coal treated at the gas-works; and therefore the therm can be sold at a lower price. Furthermore, a fortnight ago Mr. Wood's article stated that such lower calorific value gas per cubic foot can be utilized for domestic purposes with an efficiency equal to higher grade gas, and with the advantage that it does not call for such structural refinements in the consuming appliances, nor does it need the exercise of such scrupulous care on the part of the consumers in the matter of regulation. Now Sir Dugald tells us in the present article that for motive power it is not necessary to produce a gas of high calorific value per cubic foot—in fact, a low calorific power gas is, if anything, better than one of high calorific power. And the reasons are well known—for instance, at relatively low compression a rich gas may cause pre-ignition. Thus we see all along the line that therm production and utilization are acting in unison for the advantage of the gas industry.

As to the second direction in which the gas industry must work. It has not got the business of supplying large gas-engines, and why? Simply because the heat units it supplies are too costly. But is there any reason why the gas industry should not have this business in areas where factories are concentrated? From the point of view of efficiency, it matters little to the gas-engine whether the gas is of quite low thermal value per cubic foot or otherwise. The manufacturer using large engines, as Sir Dugald points out, finds that it pays him better to put in producer-gas plant in one form or another than to take town gas at the present prices per therm. He has capital charges, maintenance, labour, fuel supplies, and much else to satisfy. Nevertheless it pays him. The producer plant is a competitor of the gas industry. It can be regarded in no other light. Then what can the gas industry do to meet the competition of the private low-grade gas-making plant. Sir George Beilby, in the Board of Fuel research report, supplied the answer; the Gas Regulation Act gives the Board of Trade power to authorize what he suggested, though prior to that individual undertakings had secured power-gas supply rights. Where conditions favour, gas undertakings ought to be able to furnish a second supply of gas of low-grade and at low cost to manufacturers for the needs of large gas-engines—thus relieving them of all the attendant disadvantages of running plants of their own, and securing the economy which the gas undertakings should be able to obtain from the diversity and extent of demand. We are moving forward. Complete gasification has already taken root in the industry. Outside producer-gas plants are used for supplying gas for heating retorts. The step is not a great one to the making and distribution of a low-grade gas for large engine purposes in industrial districts.

To the gas industry, gas-engine inventors and manufacturers are indebted for their early success and progress. This acknowledgment is made by Sir Dugald Clerk. They are indebted to it still for the large business they do in the supply of gas for the smaller powers. But for the larger powers, they have had to look for assistance outside the gas industry. That is the point at which the two industries should attempt to continue the unity of their businesses for mutual advantage; but it is up to the gas industry to open the way by the development of a second gas supply. The Board of Fuel Research report and the Gas Regulation Act sought to enlarge both the outlook and the possibilities of the industry. The time has come when Sir Dugald has good hope that the advocacy of many years will materialize in substantial manner.

## Other Industrial Uses of Gas.

GENERAL industrial uses of gas follow on the special one of supplying gas for power. Without going into specific uses, Mr. Ralph Halkett, the General Manager of the Sheffield Gas Company, opens-up in the second article this week consideration of the new Act as it applies to the industrial load; and he, like Sir Dugald Clerk, sees a vast field for the

development of the business relations of gas undertakings with other industries, if there is adoption of the economy producing possibilities in gas manufacture which the new Act so freely permits. Expansion of the industrial business is largely a question of price per therm, combined with successes in developing the thermal efficiencies of the appliances used. The war furnished one of the best pieces of propaganda work that gas could have in the industrial region. But there is more to be accomplished. Of course, during the war, in new work, everything was hastily done; and there was pressure on all sides.

In the circumstances, there was not, and could not be, the same refinement of application and performance as is possible under normal working conditions; and perhaps this is the reason why Mr. Halkett writes: "Some of the economic "properties of the gas installation only indirectly touched "the pocket of the manufacturer; and there is no getting "away from the fact that money is the deciding factor." We agree as to money being the deciding factor. But manufacturers are keenly alive to-day to the tributaries to economy and efficiency—be they direct or indirect. The manufacturer knows that a means of performing heating operations that saves labour, that expedites work, that thus increases works' output, that produces greater uniformity of result, that yields less waste, that is adjustable to the character of the work to be done, represents very direct money advantages, though not shown by the gas bill. However, Mr. Halkett strongly advocates that too much reliance shall not be placed upon the inherent advantages of using gas; but that the utmost shall be done by the gas manufacturer to utilize the processes that offer for the economical production of gas, so that the reduced cost has tangible expression in the cash that has to be directly paid for the heat units. The ideal is to make the use of heat units supplied in the form of gas an attractive commercial proposition (distinct from the concomitant benefits) for all industrial work—whether the work be large or small; for the load is a fairly continuous one throughout the year, and not as the domestic gas-fire load—something that is seasonal only.

Touching the question of the gas that can be most economically produced and distributed, Mr. Halkett holds that "development should proceed along the line of supplying "a gas each cubic foot of which will, as nearly as possible, "produce the same result to the consumer as at present, "but at reduced cost." We agree with the reduced cost, but have no particular friendliness for the limitation conveyed by the "cubic foot." One of the objects of these articles is to promote thinking and speaking in terms of heat units; and, looking beyond the heat units contained in a cubic foot of gas, and the work that the heat units in a cubic foot will do, we see that, within a long range of calorific values per cubic foot of gas, the heat units in a cubic foot of gas-air mixture at the burner head are approximately the same, and that the cubic foot of gas-air mixture—not the cubic foot of gas—will as nearly as possible produce the same result to the consumer. That is one reason for the existence of the Gas Regulation Act; it is one of the reasons for the therm being the new basis of charge; and it is one of the grounds for anticipating production economies. But the whole tenor of the article shows that Mr. Halkett is out for the maximum producing economy. The working experiments with new plant that the Sheffield Company have in hand show that they are seeking to apply in a practical way all contemporary knowledge to the production of gas that will most economically and satisfactorily suit local demands. Equally emphatic is he when he says that "if "we are energetically to speed-up the future possibilities of "the industrial load to anything like the dimensions desir-"able, very earnest thought must be given to the question "of furnace designs with a view to final economy," and he points to the source of heat leakage which is so obvious in many cases. Mr. Halkett also urges the value of having a special officer who shall take charge of the work of ensuring efficient service to the consumers. Such an officer in an undertaking with a business large enough to support one is a good-paying proposition. Day by day he gathers experience of gas appliances in practical service. This experience (if the official is a wideawake one) increases the worth of his counsel and the maintenance of efficiency in a part of the system of a gas undertaking which is equally as essential to its stability as the producing end. And it has always to be remembered that the work of the industry where the highest efficiency prevails is as important to the community as to the industry itself. Interests are identical.

## Gas Undertakings and Electricity Deficits.

GAS undertakings to-day have sufficient burdens of their own to bear; and these include a large increase in rates. Among the financial hardships of some of them is the one brought upon them by municipally mismanaged electricity concerns, which produce deficits that the ratepayers (among whom gas undertakings are generally the largest, or nearly so) have to liquidate. Thus the ludicrous position is created, and is supported by the omissions of statutory enactment, that gas undertakings and so gas consumers have to support the badly administered competing electricity concerns; and this gross injustice is allowed by the Legislature to continue. Now is the opportune time for the gas industry to put forward a strong effort to get by general enactment this condition of things remedied; and the changes that are now being inaugurated in the electricity supply industry, and the financial spendings and lendings for which authority is to be given to local bodies by the Electricity Supply Bill (No. 2), which it is hoped to pass through Parliament in the coming session, are grounds on which to proceed. It may be argued by some that this is a matter—the ensuring that electricity undertakings are conducted in a manner that shall make them self-supporting—that can only be dealt with in the No. 2 Electricity Bill to the extent of the fresh financial commitments on the part of local authorities which it is proposed the measure shall authorize. This is not so, as the Electricity Supply Act of 1919, which brought the Electricity Commissioners into existence and authorized the formation of Joint Electricity Authorities for defined areas, contained several amendments of the General Electric Lighting Acts, and conferred power on all authorized distributors of electricity in respect of overhead wires, wayleaves, hiring-out of appliances, and so forth.

There is precedent then for dealing with a general matter such as ensuring that the charges made by electricity supply undertakings shall meet all their financial obligations; and, as a matter of fact, this would only require the addition of a phrase or two to one of the clauses in the new Electricity Supply Bill (No. 2), by which clause the Electricity Commissioners will have conferred upon them the power to ensure that the prices charged by electricity generating Joint Authorities shall meet expenditure, and to impose conditions securing the benefit to consumers of any reduction in cost arising from the new condition of things. All that the gas industry wants is that the powers in this respect that the Commissioners are to have in regard to the operations of the joint authorities shall be extended to electricity suppliers who are local authorities, and who at present simply fall back upon the over-burdened ratepayers when their charges for electricity do not supply revenue sufficient to cover their financial obligations. Parliament has on various occasions recognized the justice of the application of gas undertakings for protection against electricity deficits being chargeable on the rates, instead of being met by increasing the revenue by making adequate charges. The Bermondsey, Northumberland, and Winchester clauses are examples of what has been done in individual cases; but now that the electricity industry is under reorganization, and large new expenditure is contemplated, is the time to press for the security of the ratepayers by general enactment against the continued imposition of electricity deficits. The gas industry should be moving—not because of any fear it possesses that the reorganization of the generating work of the electricity industry will create more forceful competition, but purely on the ground of justice as between municipal venture and private enterprise.

In the "Electricity Supply Memoranda" last week, reference was made to Hastings; and there are points in what was then said which have relation to the main purpose of this article, and to the proposal to establish a joint electricity generating station in the neighbourhood. We know what has happened at Hastings. It is common knowledge among interested people that the deficits in the trading of the municipally administered electricity concern have been in the aggregate £32,000—a part of which the gas consumers, through the Gas Company, have had to bear compulsorily, apart from their own direct contribution as ratepayers. We saw last week, too, what peculiar views some of the councillors hold regarding the operations of such a technically based concern. There is sufficient cause in these facts to make the ratepayers, if they fully appreciate them, tremble for the future if the Hastings Corporation get deeply involved in a large joint scheme of electricity generation—and particu-

larly at present costs. On the other hand, the Corporation are themselves spending a considerable amount of money in mains and services; and if the joint station does not materialize, a further expenditure of £25,000 to £50,000 will be necessary on plant to meet the maximum demand arising from the connection of many small lighting consumers. Raising money for electricity purposes means high annual sinking fund and interest charges, so that, unless proper prices are charged for the current sold, there is bound to be a deficiency; and, if legitimate trading is followed, there is little prospect of cheap electricity. The Corporation have an Order under the Statutory Undertakings (Temporary Increase of Charges) Act by which they are entitled to charge up to 1s. per unit, instead of their former maximum of 8d. But local Press reports state that the Chairman of the Electricity Committee recently suggested in the Council that they are bound by law to supply current at present rates. This (if a correct representation of what the Chairman said) is one of the half-truths on which some electrical concerns thrive, and perhaps it deceives a large section of the public. The Electricity Committee are, of course, bound to maintain as far as possible a supply to existing consumers. But the actual control of the price is the maximum; and there is no earthly reason why they should continue to supply current for cooking, heating, and power (which they seem to imagine is always in the daytime) at 2¼d. per unit, which is the same price as is charged at Newcastle-on-Tyne for similar purposes. Mr. Riddle, a Labour member of the Council, suggested, no doubt owing to the higher price received (9¾d.), that lighting customers should be supplied in preference to these day-load consumers. But, of course, he overlooked the incidence of the maximum demand or peak-load.

Another speaker—a lawyer—told the other members of the Council and of the Electricity Committee that the day-load supply was "practically all profit"—another half-truth very easily swallowed by the ignorant. In this connection the published accounts of the Department for the year ended March 31, 1920, are interesting. As already indicated, the price of the so-called day-load current is now 2¼d. per unit; and this, it is said, "is practically all profit." It is obvious that the generation of current in the daylight hours cannot be so economical *per unit* as that generated during the hours of maximum demand. It therefore follows that costs in the daytime are *in excess of the average*, and that, however desirable it may be to load-up machinery which would have to be kept going to supply a continuous demand, it is the fact that they are deliberately supplying this current at under the cost of production. Thus a loss is incurred which has to be made good by lighting consumers, or (as is so often the case) by the ratepayers. The published figures show that the average costs per unit sold last year were: Fuel, 1·65d.; oil and waste and water, 0·16d.; and engine-room wages, 0·46d. The total of these three items alone is 2·27d., or in excess of the charge of 2¼d. per unit. Here we have ignored repairs and maintenance, management, and other costs, apart altogether from standing charges, such as interest and sinking fund. A differentiation between lighting load and day load is a policy justifiable; but there is not the slightest justification for the difference between 9¾d. and 2¼d. At Newcastle the difference is 6d. and 2¼d., which is more reasonable.

It is patent that these day-load charges are kept down to prices ruinous to the Department in order to appear to compete with gas. It is a very important matter, because if such people are to run joint stations, ratepayers (of which gas companies are often the largest) will be in a very serious position. It is therefore sincerely hoped that the Electricity Supply Bill will be amended in clauses where it is pertinent by definite wording that debts due to, or incurred for, electricity trading shall be paid directly or indirectly by the electricity consumers.

## An Unwarranted Rejection at Manchester.

THE announcement in our news columns last week that the Bill which was to sanction, among other things, the large Partington gas scheme of the Manchester Corporation, together with the Stretford gas-works purchase, had been rejected at a ratepayers meeting was somewhat of a surprise; and it gives rise to certain reflections. It is quite evident that the merits of the scheme did not receive the slightest consideration, and that motives altogether outside it were responsible for its being shunted on one side, and prevented from going forward, unless the time and money wasting poll that has been forced upon the City Council reverses the decision. It does not appear from what is said in authoritative quarters that the gas scheme had anything to do with the (we hope temporary) overthrow of the Bill. In the main, it was due to the disappointment of a section of the ratepayers over the action of the Council in expunging from the Bill clauses relating to the rating of land values; and this was a way of wreaking their vengeance upon the Council. To cause to be deferred the obtaining of statutory powers for a scheme of large economic potentiality is a poor way of showing resentment; and we can quite understand that the Lord Mayor (Alderman William Kay), who is also Chairman of the Gas Committee, feels some little indignation over the scheme and the Stretford purchase being delayed by this method of taking revenge—a method which could be best described in language which might not appear altogether polite if put into print.

It is also asserted that there were some ratepayers at the meeting who opposed on the ground that now is not the time to spend money on new schemes. We are as strongly hostile as anyone to the spending of money in these days on new schemes unless they will bear an investigation which shows that they will be productive of profit and benefit. It is true the estimate for the scheme is £6,000,000. But the demand for gas at Manchester has increased, and is increasing when industry is in good swing, at a rapid rate; and the plant moves on to a state when the best efficiency cannot be obtained from it. Enlargements and renewals of works are necessary. The time is opportune for Manchester to make preparations for the concentration of the manufacture of gas on a site that will secure to the gas consumers economic advantages, and to the citizens ultimately relief from the presence of gas-manufacturing operations within the city itself. When the time has come for manufacturing concentration, then it is a good thing to be in a position to obtain a site near to coal supplies; and Manchester was fortunate in this respect. Then again the Manchester Gas Department is in a fine position in regard to outstanding capital. It is only 3s. 3d. per 1000 c.ft.—1d. per 1000 more than Birmingham and 3d. more than Widnes, calculating on the 1919 figures. "Field's Analysis" shows that the next best among the figures of the municipal gas undertakings whose accounts are dealt with is 7s., which is more than double the Manchester figure. Though the details of the new gas scheme are not before us, we feel certain on general considerations alone that those who rejected the Bill for a motive altogether foreign to the gas scheme did Manchester a great disservice; those people who voted against the Bill because they cannot discriminate between profitable expenditure and pseudo-economy are more to be pitied than blamed. But it is the action of such people that is as repugnant to the interests of the community as is the action of those who in these times indulge in large unprofitable and not pressing expenditure. We trust the poll will reverse the decision of the ratepayers' meeting.

## Gas Coal Supplies and Exports—Lessons for the Miners.

ABOUT a month ago gas undertakings in some districts were still complaining of shortage of supplies; but there should be no occasion for any such complaint to-day. The situation has been almost dramatically reversed through the new conditions respecting demand, both from abroad and through the industrial conditions at home. The near Continental countries are well supplied, and are anything but eager at present to take our coal. The result is that, particularly in South Wales, many miners are not working at all, others are on short time, and those who are on full time think themselves fortunate in these days when they are receiving the additional 3s. 6d. per shift in accordance with the strike agreement. It is doubtful whether 1s. 6d. of the 3s. 6d. will continue beyond this month; and it is highly probable that the miners will then be back at the 2s. addition for the next two months of the period before the new agreement as to standard wages (if agreement is arrived at) can come into operation. The lessons of these times of reverse in the coal industry should be of a healthy order, and make some impression upon the future policy of the Miners' Federation, the Executive of which cannot rule economic conditions, but can create a state of things which gives opportunities in coal competition to which formerly this country has been unaccustomed. They have been doing so; and it is partly

due to this policy that so many of the coal miners are unemployed to-day.

The home demand for coal being what it is, the exports being down, fewer men working, and wagons standing filled and yet unwanted, naturally the output is now on the decline. Actually what it stands at we do not know yet. But for the week ending Jan. 8, it was only 4,344,500 tons—nearly a million tons short of the excellent week's work that ended on Dec. 18, when 5,307,000 tons were raised. The low outputs of the two intervening weeks are not surprising—covering as they did Christmas week up to the New Year. The drop in output for the week ending Jan. 8, was contributed to by all the fields, but least of all by Yorkshire, and Derby, Notts, and Leicester. But South Wales (depending so much upon the export trade) shows up very badly. The glut of coal in France—through American competition and German coal supplied under the Peace Treaty—is the most effective cause of this; and British coal is now being offered for shipment to France at about 70s. a ton, which is a recession of something like 25 p.ct. Last year the highest monthly average f.o.b. price of coal exported from this country was £4 9s. 9d., and that was in September; while August came next with £4 7s. 1d. One sign of the plentiful supply of coal in France is that the boulevards and the principal thoroughfares of Paris have once more assumed at night time their old pre-war brilliancy; and cafés and restaurants are now allowed to remain open till 1 a.m. The total coal sent from our ports during the past year was 24,931,853 tons; and the value was £99,627,146. Taking the complete year, this country did not therefore do at all badly in respect of revenue from coal; seeing that 35,249,568 tons were shipped in 1919, and the value of this larger quantity was lower—£83,213,714. These figures look strange when contrasted with those in the returns for 1913. In that year no less than 73,400,118 tons were exported, and the value was £50,727,252. Of the total coal sent abroad last year, 2,204,571 tons were gas coal; the value being £8,682,503, or an average of £3 18s. 9d. By December a decline had already set in; the average value of the 292,991 tons of gas coal exported during the month being £3 15s. 2d. per ton. In 1919, the quantity of gas coal shipped was 3,342,019 tons, or over a million tons more; and the average value was £2 8s. 4d. The 11,527,686 tons of gas coal exported in 1913 only had an average value per ton of 12s. 5d.; and the total value was about 1½ millions less than was received last year for approximately 20 p.ct. of the quantity.

The coal industry has arrived at the position when it has to meet active competition in its overseas coal markets, which is a position the industry (including the miners) has to face. The ability to compete depends very much on the costs of production; and if costs cannot be adjusted so that the law of supply and demand can again come into operation, then the miners will find that unemployment among them will be an ever-increasing condition. And regarding supply, recent times have shown us that any deficiency on our part is the opportunity of other countries. Their opportunity has resulted in a condition of things which has put British miners and seamen out of work, and has made the coal and shipping industries less profitable than they would have been otherwise.

## Slide in Gas Coke Export Prices.

The Board of Trade returns for December show that during the year 770,265 tons of gas coke were exported, of the value of £4,751,605, which works out to an average of £6 3s. 4d. per ton. But this average is no real indication of the high prices that were secured at times during the year by various undertakings. When Stockton-on-Tees brought down the price of gas to 1s. 6d. per 1000 c.ft., less 15 p.ct. discount, the average they were receiving for coke was £8 per ton; and we have heard of prices as high as £12 having been paid. So that the average value for the year does not by any means reflect the best receipts for shipped coke. According to the Board of Trade returns, the average value received for gas coke in September was £8 4s. 6d. per ton; in October, £7 2s. 1d.; and in November, £6 11s. 2d. The quantity of gas coke exported during the month of December was 74,171 tons; and the average value was £5 19s. 8d. per ton. Prices are much lower now; and when the January returns come in, so report says, there will be seen a further slide. A fortnight ago, we heard of £3 per ton having been paid for coke for export. Now gas undertakings who, through the shipped coke windfall, made drastic reductions in the price of gas to avoid the payment of E.P.D., are having very reluctantly to retrace their steps. For instance, in Stockton and Thornaby the price of gas is to be doubled—making it 3s. (and in other areas higher), with a discount of 10 p.ct. A year ago the price was about 4s. 2d.; so that the consumers have nothing whatever of which to complain, compared with consumers in other places where coke could not during the past year be disposed of abroad. Even now Stockton consumers are being charged considerably less than consumers in most places. From the South, we look with envious eyes upon Stockton's 3s., and the substantial discount.

## Mineral Constituents of Coal.

Coal offers an illimitable area for study. Even the people who mine and deal in coal do not know all about it; and the scientists are continually discovering fresh ground for investigation. An old subject in which Dr. Lessing has interested himself scientifically is as to the distribution and characteristics of the mineral matter in coal. He was dealing, as will be seen by a report in this issue, with the topic last Saturday before the Midland Institute of Mining, Civil, and Mechanical Engineers. Dr. Lessing does not like ash in coal any more than do those consumers who use it in large quantities; and his whole paper goes to show that careful scientific study of the distribution and characteristics of the mineral matter in coal would or should lead to a great improvement in the efficiency of washing processes. But Dr. Lessing suggests that we shall not be too severe in our condemnation of ash, and not regard it merely from a quantitative point of view as a certain amount of inert matter. Some of the ash, depending upon its nature, may be really serviceable in the reactions that occur during carbonization; and, as in the Young Memorial Lecture in 1914, so in this paper Dr. Lessing draws attention to the catalytic influence which certain mineral ingredients have upon spontaneous combustion, and particularly upon the carbonization of coal. The William Young lecture referred to is worth reperusal to-day. There may be beneficial catalytic effects; but all the same a given coal containing (say) 8 p.ct. of ash is, from the gas making or any other point of view, much better than one containing (say) 30 p.ct. And the results per ton of the one are better than those of the other; and the quality of the coke, the conditions of treatment being equal, is much better. Of course, Dr. Lessing does not say anything to the contrary; for his whole paper is directed to the knowledge derived from the investigation of impurities of coal leading to cleaner and more suitable coal. At the same time there should not be unmerited condemnation of all constituents labelled "ash." The customary ash test is not sufficiently informative. Fuller examination of the constituents assists to a better determination of the suitability of coal for different purposes.

## National Association of Technical Gas Officials.

Little has been heard of this Association of late; and there has been some feeling abroad that the new organization would soon be drawing its last breath. But those who have entertained this idea will learn, from a report (published to-day) of a meeting held in Birmingham, that there are men in the Association who regard it as highly essential to the interests of the gas profession, and who are not going to spare any effort in trying to make it an effective instrument for good in obtaining proper recognition for the intrinsic status of technical gas men, and an adequate reward for their services. The curves of recognition and reward have some very deep valleys in them; and to reduce these, so as to make the professional ranks more attractive, is the object in view. To speak plainly, there has not been enough motive power in the Association; and the members have not cared much to come out on to the open platform. There would not be this reticence if the whole of the gas profession—those who are in good service as well as all who are not in the same enviable position—would link-up for the common good of the profession. What is now to be done, with Mr. R. G. Shadbolt acting as Chairman of the General Council until the next general meeting, is to take energetic action in the effort to broaden and deepen the basis of the organization by increasing the membership, and to back-up its objects by much greater activity and enthusiasm. As soon as possible, an endeavour is to be made to form a Whitley Council for technical gas officials. There is greater confidence to-day among the

members than there was before the Birmingham meeting that the Association will now be put into a position to accomplish effective work. This will depend upon the manner in which work is planned and carried out, and upon every member using his influence to extend the membership.

## PERSONAL.

Bailie THOMAS PAXTON, at one time Chairman of the Corporation Gas Committee, but better known to readers of the "JOURNAL" in his late capacity of President of the British Commercial Gas Association, has been elected Lord Provost of Glasgow.

## OBITUARY.

The "Journal of the Society of Chemical Industry" announces the death, on Dec. 1, of Mr. ROBERT TERVET, of Leyton, an original member of the Society, who contributed papers on destructive distillation and on the production of ammonia from coke—showing the possibility of obtaining a yield of ammonia equivalent to 57 lbs. of sulphate of ammonia per ton of coal, by passing hydrogen over the incandescent coke remaining after carbonization; the hydrogen combining with the residual nitrogen of the coke.

## CHANGES IN GERMANY.

WE have just received, under a new name, the first 1921 number of our contemporary, the "Journal für Gasbeleuchtung und Wasserfach," which, with the issue in question, becomes merely "Das Gas-und Wasserfach." The reason for the change of name is as obvious as was ours a few years ago when we became the "GAS JOURNAL," instead of the "JOURNAL OF GAS LIGHTING," since the German gas industry is no more confined in these days to "beleuchtung" than ours is to lighting.

The change of name will make no difference to the policy of our contemporary—it is merely more suitable to the wider scope of the gas industry to-day. But another change is announced at the same time, and that is the retirement from the active editorship of the journal of Prof. Dr. Hans Bunte. That doyen of the German gas industry joined the staff of the paper in 1874; became joint editor in 1876; and since 1884 has been sole editor. Thus it is after 46 years' continuous service that he has handed over the control to younger men. His work will be carried on by Dr. Karl Bunte, who is head of the Karlsruhe Experimental and Instructional Gas Institute, and Herr Karl Lempelius, of the German Commercial Gas Association, who are both leaders of the gas industry in Germany.

Few of us, probably, have had the opportunity of meeting Dr. Hans Bunte since 1914. But those who knew him personally in pre-war days cannot fail to recall his genial personality, his unfailing courtesy on all occasions, and the helping hand that he was ever ready to extend to strangers in his land. He has served the German gas industry well, and, through the pages of his journal, the gas industry of the world.

### Gas Light and Coke Company's Dividend.

The Secretary (Mr. W. L. Galbraith) intimates that the accounts of the Gas Light and Coke Company for the past year show that, subject to audit and to the approval of the Board of Trade, the balance to the credit of the net revenue account will enable the Directors to recommend the payment of dividends for the half year to Dec. 31 last at the rate of £2 12s. 6d. p.ct. per annum on the 3½ p.ct. maximum stock, and at the rate of £3 p.ct. per annum on the ordinary stock—carrying forward to the next account the sum of £326,597 19s. 3d.

### Dividend of the South Metropolitan Gas Company.

We are informed by Mr. Frank Day (the Secretary and Accountant) that, subject to audit of the accounts, the Directors of the South Metropolitan Gas Company will recommend the payment of a dividend on the ordinary stock of the Company of 5 p.ct. for the year 1920, including the interim dividend of 1½ p.ct. paid in September last.

**Care Must be Given to Tubing.**—Officially compiled figures show that accidental gas asphyxiation was responsible for 375 deaths in New York City during the first eleven months of 1920; while a conservative estimate of the deaths in December from the same cause (records of which have not yet been completed), would be 25. Most of these fatalities, it is declared, were due to defective rubber tubing attached to gas-heaters; 80 p.ct. of the deaths having occurred in the winter months, when heaters are in use. The need for the exercise of the greatest possible care in this matter is shown by the remark of Dr. Norris (Medical Examiner) that "more than 50 p.ct. of these deaths could have been prevented by the enactment of an ordinance which would compel the use of reliable tubing."

## INSTITUTION OF GAS ENGINEERS.

### Council Meeting.

A Meeting of the Council of the Institution of Gas Engineers was held at No. 30, Grosvenor Gardens, Westminster, last Friday—the President (Mr. Thomas Goulden) in the chair.

After the usual formal business, the deceases of the following were reported, and the sympathy of the Council was expressed with the bereaved: Mr. Leonard G. Barber (Cambridge), Mr. Ernest W. Drew (London), Mr. Alfred T. Harris (Market Harborough), Mr. Robert O. Paterson (formerly of Cheltenham), and Mr. Edward Price (formerly of Hampton Wick).

The Institution's congratulations were offered to Dr. F. Mollwo Perkin on the honour of Commander of the Order of the British Empire which had been conferred upon him, and to Mr. Percival J. Channon who had been made an Officer of the Order.

Correspondence was reported with the British Section of the Société des Ingenieurs Civils de France on their proposal for the adoption of the mining and manufacturing town of Loos, near Lens; and it was agreed that the Institution should, with other British Engineering Societies, associate itself with the movement.

PROPOSED ENGINEERS' CLUB.

A memorandum setting forth the initial steps which were being taken with the object of founding an Engineers' Club in the Metropolis was laid before the meeting; and it was stated that the intention was that membership should be obtained, not from London alone, but from the Provinces and the Overseas Dominions. The President was nominated to serve on the preliminary Committee. Those who are in favour of such a club are invited to send their names to Mr. Edmund L. Hill, No. 39, St. James' Street, London, S.W., Hon. Secretary, *pro tem.*

A message had been received from the Association of Italian Gas and Water Industries conveying fraternal greetings to the Institution.

The following were approved as candidates for the next ballot: For the class of member: Mr. John Brabbs (Hyde), Mr. Herbert J. Carpenter (Bristol), Mr. Stanley E. Chaplin (Beckton), Mr. Stewart O. Pacey (Santos, Brazil), and Mr. William J. Whyte (Seaham Harbour). For the class of associate member: Mr. George Briggs (Hyde), Mr. R. B. Culbertson (Westminster), Mr. William T. Kenshole (Lea Bridge), Mr. Charles H. Nicholls (Stratford), Mr. William H. Reed (Leamington), and Mr. Frank W. Stapleton (Kensal Green). Mr. Henry Gage (Rochester), Mr. John W. Halstead (Horsham), and Mr. Edward P. Vince (Minehead) were transferred from the class of associate member to that of member; and the following were admitted students: Mr. Roy Summerson (Luton) and Mr. Chas. R. Ingham (Ossett).

THE ANNUAL MEETING.

Arrangements for the annual general meeting were considered. Tuesday, May 24, was decided upon for the opening session. The Société Technique de l'Industrie du Gaz en France have accepted an invitation to be present.

EDUCATION OF GAS ENGINEERS.

Further consideration was given to the scheme for the education of gas engineers. Correspondence on the matter with the Board of Education was reported. The suggestion of the Board for the formation of an Advisory Committee consisting of three members of the Board and three members of the Institution, to consider details, was agreed to; the President, Mr. F. W. Goodenough, and Mr. Walter Hole being appointed to represent the Institution. This Committee are to act in co-operation with the Advisory Committee on Education appointed by the Joint Industrial Council for the Gas Industry.

Having regard to the time which would be required to develop the scheme and complete all the necessary arrangements, it was resolved that the City and Guilds of London Institute be requested to revive temporarily the lower grade examinations, which had been discontinued by arrangement with the Board of Education.

STANDARD CONDITIONS OF CONTRACT.

The report of a conference of the Emergency Committee with representatives of the Society of British Gas Industries was considered, as to the desirability, in view of changed financial conditions, of a revision of the payment terms as set forth in clause 27 of the present Standard Conditions of Contract approved by the Institution and the Society. The Council agreed to certain modifications, to be forwarded for the consideration of the Society's representatives.

It was reported in connection with the British Refractories Research Association, of which the Institution is a member, that a Sub-Committee on Gas Research had been formed; and that the Joint Research Committee of the Institution and the Society of British Gas Industries had appointed Messrs. A. E. Broadberry, Thomas Hardie, J. P. Leather, and W. E. Price to represent the Institution, and Messrs. T. Allen, M. Barrett, Albert Cliff, and G. H. Pearson Perry to represent the Society on this Sub-Committee.

A report of the Joint Committee (Research Sub-Committee and Institution Committee) on Recording Gas Calorimeters was presented, indicating the progress which had been made in the investigation. Sir Dugald Clerk communicated further informa-

tion on the subject; and arrangements were made for continuing the work.

The formation of a Sectional Committee on Chemical Engineering in connection with the British Engineering Standards Association was reported. The nomination of Mr. John Terrace as the Institution's representative was confirmed. It was agreed that the Institution should support the proposal of the Association's China Local Standards Committee for a standard specification for steel tubes.

THE KELVIN MEDAL.

It was resolved that Dr. W. Cawthorne Unwin, F.R.S., be nominated by the Institution of Gas Engineers for the Kelvin Gold Medal which is awarded triennially "as a mark of distinction to a person who has reached high eminence as an engineer or investigator in the kind of work applicable to the advancement of engineering with which Lord Kelvin was especially identified."

The report of the Finance Committee was presented, accepted, and adopted, including the accounts for the year ended Dec. 31, 1920.

Communications were considered and dealt with from the National Gas Council with reference to inquiries to be held by the Board of Trade into the permissible proportion of carbon monoxide and inerts under the Gas Regulation Act, 1920; also in regard to the work of the Council's Spent Oxide and Sulphuric Acid Committee.

## SIXTY YEARS AGO.

**[From the "Journal" for January, 1861.]**

**Death of Samuel Clegg.**—This day [Jan. 15] the grave closes over the mortal remains of Samuel Clegg. He has passed away, full of years and crowned with honour; but the memory of "the father of gas lighting" will be cherished as long as ingenuity, skill, energy, truth, and rectitude are valued among men. He breathed his last peacefully on the 8th inst., at the residence of his son-in-law, in the Adelaide Road, near Hampstead, at the advanced age of 79, in full possession of his faculties, which remained bright and clear to the end. Samuel Clegg earned for himself a world-wide reputation as the founder of a system of artificial lighting that completely revolutionized former methods of illumination, and which, among the many inventions of the present century, yields only to railways and to the electric telegraph in its influence on the social and economic condition of society. Of the importance of this system—which, if not invented, was at least first successfully established by the efforts of Samuel Clegg—some idea may be formed from the amount of capital and labour employed in its operation. In this country alone, the capital invested in gas-works is estimated at not less than £30,000,000, in addition to the sums employed in the various trades associated with the supply of gas, including ironfounders, fire-brick makers, tube makers, brassfounders, meter manufacturers, gas-fitters, &c. It is no small consideration also that all the apparatus employed is of native manufacture, and that every shilling expended is applied in employing the labour of our countrymen. The value of the gas annually consumed in the United Kingdom is estimated at £5,000,000; and the coal used in the manufacture amounts yearly to the enormous quantity of 3,500,000 tons. Nor is the influence of gas lighting on the capital and labour of this country limited to these sums, prodigious as they seem, for the coal and iron used in foreign gas-works are principally derived from England. Such is a brief outline of the extent and influence of the new industry that was mainly created by Samuel Clegg. Winsor, the two Crosleys, John Malam, and many other of his coadjutors in the great work, have long preceded him to the grave; but we have yet left among us Lowe, Neilson, G. H. Palmer, and Grafton, as connecting-links with the past—men who strenuously laboured with him whose death we now mourn in overcoming the obstacles that stood in the way of the success which they ultimately accomplished. Samuel Clegg was born at Manchester on March 2, 1781. His scientific education was chiefly directed by the well-known Dr. Dalton; and he was afterwards apprenticed to Messrs. Boulton and Watt, at the Soho factory. In that school, where Watt and Murdoch were bright exemplars, he was thoroughly trained in the practical details of engineering. Mr. Murdoch was then carrying on his experiments regarding the application of coal gas as a means of illumination; and Clegg's active mind entered eagerly into the investigation.

**Consumers Must be Able to Read Meters.**—The regulations which have been issued by the Montana Public Service Commission, and which have been taken from those adopted by the Federal Bureau of Standards, prescribe that public utility undertakings shall adopt a method whereby all consumers may learn to read gas-meters—either by printing the method on the bills, or by a special card with diagrams. The undertaking must also supply laboratory meter-testing equipment. All meters must be adjusted to within 1 p.ct. of being perfect before being installed. No meter may be fitted up in a spot where climatic conditions may cause a change in operation. During each year after these rules have become effective, every undertaking must (until all meters in service have been tested) remove and test 20 p.ct., beginning with those which have been installed for the longest period.

## NATIONAL ASSOCIATION OF TECHNICAL GAS OFFICIALS.

**Meeting in Birmingham.**

Following District Committee meetings which were called early in the month, a meeting was held at the Imperial Hotel in Birmingham on Tuesday, the 18th inst., of the members elected to the General Council and other representatives from each district. The meeting was well attended; representatives being present from all eight districts. The following outline report of the proceedings has been sent for publication.

The meeting was called for the purpose of receiving resignations from members of the original Executive, and discussing fully the affairs of the "N.A.T.G.O." The resignations of the Executive were received with regret, and several opinions were expressed that the Association was much indebted to these gentlemen for the time and energy they had expended in the difficult spade-work that had been necessary.

The affairs of the Association generally were discussed fully and frankly. The opinion was freely and generally expressed that the "N.A.T.G.O." seemed to have got into a rut, and become stagnant. But all the representatives present were determined that such an Association was still most urgently needed, and its break-up was out of the question. It was determined to pull it out of the slough, and put it upon a proper footing before the next annual meeting in May or June. New blood was felt to be needed in the management, and more constitutional methods.

Members of the General Council were present from five districts in which elections had been made. The necessity of instant action was felt to be vital; and it was therefore decided that the General Council, as far as elected, should proceed to business—seats being still open, of course, to members from the few remaining districts, when they had been elected. It was resolved unanimously, and with acclamation, that Mr. R. G. Shadbolt, late Engineer and Secretary of the Grantham Gas Company, be asked to act, until the next members' general meeting, as Chairman of the General Council. Mr. Shadbolt agreed to accept this office, and promised to do all in his power to further the objects of the Association.

A general discussion took place as to the future methods of procedure of the Association. Many valuable contributions to the discussion were made by the members; the general tone and feeling of which was that progress must be made, and made quickly, by way of increasing membership, disseminating information, drawing-up draft amendments to the rules for submission to members at their next annual meeting, and endeavouring to form a "Whitley Council for Technical Gas Officials" as soon as it was thought possible so to do.

The General Council then met and elected their Executive Committee, in accordance with the rules passed (subject to future revision by the Association) at the last annual meeting. The seven members appointed were: Messrs. B. J. Bell, F. C. Briggs, J. Bridge, G. Dixon, J. Mogford, F. G. Shaw, and J. Wilson.

The Executive met and elected their Chairman, and fixed an early date for their next meeting—the time being then somewhat late, and representatives having some distance to travel.

## Bituminous Coal for Water-Gas Generators.

In the report of investigation of the United States Bureau of Mines for November, Mr. W. W. Odell discusses water-gas generator fuels, and the production of gas richer than blue gas. He says it has long been recognized that coke is a more desirable fuel than bituminous coal in water-gas apparatus of present design; but still considerable headway has been made—particularly in the Central States, where the supply of high-grade coke has been very limited—in the use of bituminous coal as a substitute for coke. Difficulties have been encountered; but they have been to a large extent overcome. The average value of the blue gas from coke fuel is 300 B.Th.U. per c.ft., whereas that from coal is 335 B.Th.U. Also, the volume and quality of the blast gas are appreciably greater when the latter fuel is used. In other words, when making carburetted gas from bituminous coal, the quality of the blue gas is so much richer than the same gas from coke, that less oil is required to carburet it to a given standard. Therefore less heat is needed for heating the chequer chambers. This condition is aggravated by the fact that more and richer blast gas than ever is available, and must be wasted at the stack in large quantities when making gas to a standard lower than 565 B.Th.U. The lower the standard, the greater the quantity of blast gas wasted. Thus with the present tendency towards lower standards for town gas, the benefits to be realized by the utilization of a waste-heat boiler, in conjunction with a combustion chamber, are at once apparent. While it is not Mr. Odell's purpose to claim that bituminous coal is better fuel than coke, he does point out: (1) Carburetted gas can be made from it cheaper than with coke, due to the fact that, though slightly more generator fuel is used per 1000 c.ft. of gas produced, the difference in the prices of coal and coke is great enough to offset this difference. (2) A still greater economy can be realized from the use of such fuel (bituminous coking coal) when a properly designed waste-heat boiler with suitable combustion chamber is provided.

# THE GAS INDUSTRY ON THE HEAT-UNIT BASIS.

## Special Articles.—IV.

THE first contribution this week to our special articles is made by Sir Dugald Clerk, the President last year of the Institution of Gas Engineers, and for many years an earnest friend of the gas industry. The facts of to-day's statutory position in the industry are a materialization of the views he has held since he first publicly expressed the opinion that scientific discovery had been kind to the industry, and had abolished the need for high illuminating power gas, and so had enabled gas to be made of lower calorific value, producing more heat energy per ton of coal used. He directs attention now to the two lines along which the industry should work to secure an extended place in the power field: First, it must work for the lowest price per therm for power purposes; and, secondly, it must consider the policy of an alternative supply of gas where circumstances allow of a quality at a price which will make it more acceptable to the manufacturer than a supply from a private producer plant. The second article is by Mr. Ralph Halkett, the General Manager of the Sheffield Gas Company. Mr. Halkett has had wide experience in industrial cities. He takes us into the use of gas for purposes other than power. More economical production and lower prices per therm are necessary to a large development of business in industrial gas; and he believes the Gas Regulation Act is going to help the industry greatly in this connection. He also emphasizes the importance of securing higher thermal efficiencies in industrial appliances.

## THE HEAT-UNIT BASIS IN RELATION TO POWER SUPPLY.

By Sir DUGALD CLERK, K.B.E., LL.D., D.Sc., F.R.S.

I HAVE read the valuable articles which have appeared in the "JOURNAL" on the new conditions of the gas industry and the question of sale on the therm basis; and the alterations desirable in manufacture have been so fully treated for light and heat supply that little remains for me to say in regard to the heat-unit basis in relation to power supply.

In the admirable article with which Mr. Milne Watson opened the series, was a most interesting account of the genesis and development of the Gas Regulation Act. He gives a great deal of credit to many people, and claims nothing for himself. We all know that, without the work of Mr. Milne Watson, the difficulties of this development might have proved too great. At the end of the article Mr. Milne Watson states: "It is too early to say what the effect of this great new charter for the gas industry may lead to; but it can, without doubt, be said that it opens-up a prospect of progress and development, the great possibilities of which cannot as yet be fully estimated." With this, I am in thorough agreement. Undoubtedly, the therm basis with the accompanying conditions permits of great variations in the process of gas manufacture; and in my opinion it should lead ultimately to the sale of gas by the therm at a much lower rate than was possible under the old conditions. The possible price, of course, depends on the price of coal; so that in discussing pre-war costs it must be borne in mind that monetary economy is relative.

### THERM COST FOR GAS MOTIVE POWER.

In my Presidential Address last year to the Institution of Gas Engineers I attempted to put a monetary value upon the therm as applied to motive power. The price I then gave was 5d. per therm. Sir George Beilby's price—quoted by me from his report as Director of Fuel Research—was 10d. per therm. This cost was five times the cost of coal at 54s. per ton. Undoubtedly, gas lighting can support a ratio such as this; but for motive power, in my opinion, the cost per therm as sold in the form of gas should not exceed three to four times the original cost per therm in the shape of coal. Gaseous fuel for internal combustion engines has very great advantages; and nothing could be better than a supply of good town's gas. As I have stated many times, it is not necessary to produce gas of high calorific value per cubic foot. For motive-power purposes low calorific power gas is, if anything, better than high calorific power gas. To increase greatly the use of gas for distributing motive power, however, it is necessary that the cost of gas per therm should not be too great. Small engines could, and do, remain in use and increase in numbers at even five and six times the coal therm cost. But when large engines are required, it very soon pays to introduce a gas producer of one type or another. It will be a matter of experiment for the gas industry to determine the minimum commercial price at which the therm can be sold. I was glad to find, however, in a paper by Mr. George Keillor, of the Greenock Gas-Works, that he was able to sell gas to manufacturers at about 7d. per therm.* Of course, the gas supply to engines must be made to pay a substantial return to the gas companies; but, in order to obtain a large increase in this branch of the gas industry, it is necessary to keep-down the cost as much as possible. The new conditions of industry will allow of experimental attempts by many gas engineers to produce a gas having the qualities suitable for gas-engine work at a minimum price. I have long been of this opinion; and I fear that I may have been too insistent in past years upon the necessity for reducing the cost per therm to a minimum.

* See "JOURNAL" for March 9, 1920, p. 555.

### HEAT UNIT FOR MOTIVE POWER NO MEANING BEFORE JOULE.

It is to be remembered that the heat-unit basis for motive power calculations is of comparatively recent origin. The scientific use of this basis began with the work of Joule. Before Joule's time it was not known that heat could be converted into work; and many theories were proposed as explaining the action of heat in steam and air engines.

The heat unit has been much used by steam and internal combustion engineers for at least eighty years as a standard of measurement of the performances of their engines. The value of the mechanical equivalent of heat was not accurately known till Joule's publication of his experiments in 1847; and even so late as 1848 Lord Kelvin (then Sir William Thomson) stated that probably heat could not be converted into mechanical work, nor could such energy be converted into heat. In 1851, he adopted the dynamical theory of heat, however, and agreed with Macquorn Rankine as to the nature of the connection between the law of Joule and that of Carnot. The brilliant work of Joule, Kelvin, Rankine, Clausius, and Mayer finally supplied the engineer with accurate reasoning as to the thermodynamics of all heat-engines. This knowledge was first used by Joule and Rankine in calculating the possible performance of a proposed hot-air engine; and in 1853 there was a discussion at the Institution of Civil Engineers in which Sir C. W. Siemens used the values so obtained for comparing the performance of different types of heat engine.

### DEVELOPMENT OF GAS AND STEAM ENGINES FROM 1876.

I began my experimental and scientific work upon the gas-engine at the end of 1876; and I was then enthusiastic regarding the new knowledge, as will be seen from my first paper to the Institution of Civil Engineers in 1882.* I concluded the paper as follows: "The steam-engine converts so small an amount of the heat used by it into work that, although it was the glory and honour of the first half of the century, it should be a standing reproach to engineers and scientists of the present time having constantly before them the researches of Mayer and Joule." At that time the thermal efficiency of the gas-engine considerably exceeded that of the steam-engine; and a long struggle ensued, in which Sir Charles Parsons and his colleagues succeeded in raising the thermal efficiency of the steam-turbine to an unexpected extent, while the inventors and designers of internal combustion engines also increased thermal efficiency and kept it ahead of all steam-engines in that respect, while developing its use for many purposes for which steam was inapplicable. The early gas-engines consumed coal gas; and all gas-engine inventors are deeply indebted to the gas industry for their early success and progress. Coal gas has many advantages as a distributor of motive power for the smaller engines; and many thousands were constructed and used in almost every industry where the absence of steam-boilers and the necessary stoking and attention were much appreciated. In a book written by me in 1885† I said: "What remains to be done, then, in order to make the gas-engine compete with steam for really large powers? At present the largest gas-engines do not indicate more than 40 H.P., and very few are in use so powerful. . . . The gas-engine, although superior in efficiency as a heat-engine to the steam-engine, is not superior in economy except for small powers, where steam-engines are very wasteful and the cost of attendance relatively great. . . . The unit of heat supplied in the form of coal gas is more costly than the unit of heat supplied in the form of coal. Gas producers are required which will convert the whole of the fuel into gas as readily as steam is produced, and with no greater loss of heat than a boiler has."

The Dowson pressure producer was then beginning its career; and it ultimately developed into the very efficient suction-gas

* "The Theory of the Gas-Engine." By Dugald Clerk. Vol. LXIX. Session 1881–82.

† "The Gas-Engine." By Dugald Clerk, p. 267. London: Longmans, Green, & Co.; 1886.

producer now largely adopted to supply gas-engines with cheap gaseous fuel. The Mond producer for semi-bituminous fuels also developed; and accordingly we see, in 1921, gas-engines up to 3000-H.P. actuated by producer gases of different kinds.

### CHEAP HEAT UNIT ADVOCATED IN 1892.

I felt strongly the desirability of distributing a gas cheap as to sale price per heat unit, in place of the existing town's coal gas; and in 1892 I supported the proposal of the late Mr. B. H. Thwaite * to supply Birmingham with a gas likely to develop for extensive industrial use, including heating and gas power. I then said: "In one of his British Association addresses, the late Sir C. W. Siemens strongly advocated the production and distribution of a separate fuel and motive power gas in our large centres." I also said: "In my opinion a good fuel and motive power gas could be manufactured and distributed at a profit at a charge to the consumer of 1s. per equivalent of 1000 c.ft. of ordinary lighting gas. . . . Such a gas need not be of high illuminating power, but would only be enriched with such a proportion of hydrocarbon as would give it an odour similar to ordinary coal gas. . . . High illuminating power is quite unnecessary; and by dispensing with the greater proportion of illuminating power, the gas may be manufactured at a very cheap rate, and the whole of the coal may be converted into gas, and the production of coke avoided. At the same time, much cheaper coal could be used than is at present necessary."

I at that time contemplated a gas of about 300 B.Th.U. per cubic foot—mixed distilled gas and water gas; and I proposed that it should be sold for engines and heating by heat units at 1s. per equivalent of 1000 c.ft. at 600 B.Th.U.—that is, 600,000 B.Th.U. per shilling or, in to-day's terminology, 2d. per therm of 100,000 B.Th.U.

### CHEAP HEAT UNIT ADVOCATED AT SOUTHAMPTON IN 1902 AND NORTH OF ENGLAND 1905.

In the year 1902 (ten years after this), I read a paper at the Southampton meeting of the Incorporated Gas Institute, on "Large Gas-Engines and the Gases Used by Them."† I then said: "It has now been proved in practice, as was already known in theory, that the heat efficiency of a compression gas-engine within wide limits does not fall with reduced flame temperature—that is, that an engine using a weak gas can convert as large a proportion of the heat into mechanical work as when a rich gas is used. The gas-engine, in fact, requires a gas which will cost as little as possible per heat unit evolved, and does not require a high flame-temperature."

Further, I stated: "Is it not possible to produce a cheap gas for town purposes, capable of incandescing Welsbach mantles, supplying gas-engines, and gas cooking and heating apparatus? A gas giving only 10 or 12 candles per cubic foot, when burned in the old way, would still give the maximum temperature required for incandescent gas lighting; and such a gas would be eminently suited for gas-engine purposes. Say that cheap coal could be used for producing the gas, and if water gas were mixed with it, no enriching oils would be required, it is surely worth the consideration of gas engineers to see whether a town supply could be given on such a scale."

In 1905 another paper by me was read at the North of England Gas Managers' Association. It was entitled "Coal Gas and its Rivals for Motive Power." I again agreed with those gas manufacturers who advocate cheap gas and low illuminating power. I stated that "intrinsic illuminating power for coal gas is an antiquated superstition, requiring dismissal from our minds in order to re-arrange the conditions which best suit the incandescent lamp, the gas-stove, and the gas-engine." I supported the use of a standard of heating power only.

I gave the following table, comparing (in cost of heat units) coal gas, anthracite, coal, Scotch anthracite, and petroleum lamp oil. I took 10,000 B.Th.U. as the heat unit, so that the B.Th.U. costs given below have only to be multiplied by 10 to give the cost at the then prices but in terms of the therm, now the legal standard.

#### A.—COAL GAS.

**(Calorific value, 600 B.Th.U. per cubic foot.)**

| | | 30 p.ct. Brake Efficiency. | | 25 p.ct. Brake Efficiency. | |
|---|---|---|---|---|---|
| Cost Per 1000 C.Ft. | Cost of 10,000 B.Th.U. | Fuel Cost Per B.H.P. Hour. | Total Cost Per B.H.P. Hour. | Fuel Cost Per B.H.P. Hour. | Total Cost Per B.H.P. Hour. |
| 1s. 0d. | 0·2d. | 0·17d. | 0·27d. | 0·20d. | 0·30d. |
| 1 6 | 0·3 | 0·24 | 0·34 | 0·29 | 0·39 |

#### B.—ANTHRACITE.

**(Calorific value, 14,000 B.Th.U. per pound.)**

| | | 30. P.Ct. Brake Efficiency.* | | 25 p.ct. Brake Efficiency.* | |
|---|---|---|---|---|---|
| Cost Per Ton. | Cost of 10,000 B.Th.U. | Fuel Cost Per B.H.P. Hour. | Total Cost Per B.H.P. Hour. | Fuel Cost Per B.H.P. Hour. | Total Cost Per B.H.P. Hour. |
| 24s. | 0·097d. | 0·092d. | 0·22d. | 0·11d. | 0·24d. |

* Assuming a producer efficiency of 85 p.ct.

#### C.—COAL.

**(Calorific value, 11,500 B Th.U. per pound).**

| | | | Steam Turbine Plant. | | |
|---|---|---|---|---|---|
| Cost per Ton. | Cost of 10,000 B.Th.U. | Fuel Cost per B.H.P. Hour at 30 P.Ct. and 85 P.Ct. | Fuel Cost per E.H.P. | Sale Price per Unit. | Price per B.H.P. at 85 P.Ct. Motor Efficiency. |
| 5s. 9d. | 0·029d. | 0·028d. | 0·0825d. | 0·55d. | 0·49d. |
| 7 6 | 0·037 | 0·035 | 0·108 | 0·72 | 0·64 |
| 8 6 | 0·044 | 0·041 | 0·120 | 0·80 | 0·72 |

#### D.—SCOTCH ANTHRACITE.

**(Calorific value, 12,000 B.Th.U. per pound).**

| Cost per Ton. | Cost of 10,000 B.Th.U. | Fuel Cost per B.H.P. Hour. |
|---|---|---|
| 15s. .. | 0·071d. .. | 0·068d |

#### E.—PETROLEUM LAMP OIL.

**(Calorific value, 20,000 B.Th.U. per pound, B.H.P. hour at 0·8 lb.)**

| Cost per Gallon. | Cost of 10,000 B.Th.U. | Fuel Cost per B.H.P. Hour. | Total Cost per B.H.P. Hour. |
|---|---|---|---|
| 6d. | 0·33d. | 0·53d. | 0·63d. |
| 4 | 0·22 | 0·35 | 0·45 |

**It is important to notice the third column of Table C. This is purely hypothetical, and shows what would be the cost of a brake-horse-power if common slack used for steam-raising could be employed in a producer on the same basis as the Dowson suction producer. This is the producer problem of the future. Table D deals with Scotch anthracite; and Table E, with heavy fuel oil used in an oil engine.**

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I concluded by saying: "I think I have said enough to clearly demonstrate the desirability of combined effort on the part of our gas companies and corporations interested in the manufacture of coal gas to alter the law of the country in such a way as practically to permit of the abandonment of intrinsic illuminating power as the standard for gas manufacture, and the substitution for that standard of one of calorific power per cubic foot, together with possibly a flame-temperature limit, so as to make gas thoroughly suitable for the incandescent lamp, even when it has no intrinsic illuminating power."

Happily, the law of the country is now altered so as to leave gas engineers great scope for reducing the cost of gas per therm; and the industry will without doubt expand rapidly in the consumption of gas for motive power as well as for heating and lighting.

It is true that the cost of coal has risen seriously; and so the cost of gas per therm must be greater than the pre-war figures which I have given. The advantages of gas for motive power are so great that in even large engines the price of gas per therm may be three or four times that of coal per therm, while leaving gas with some cost advantage over coal.

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## THE GAS REGULATION ACT AS IT APPLIES TO THE INDUSTRIAL LOAD.

By RALPH HALKETT, of Sheffield.

THE new Gas Regulation Act, 1920, directs that in future gas must be sold by the heat unit. It is some time since the heat value of gas has been recognized as a greater asset than its illuminating power. The demand for gas as a light is one of its least popular branches of utility, and even were it not so, with the incandescent gas-burner superseding the old flat-flame burner, heat is the prime factor. Therefore it is a step in the right direction; and when the Act goes further (as it does) and allows the authorities responsible for making gas to decide what quality of gas is most useful to the area they supply, and to bind themselves to supply it, still further service and stimulus are provided to the industry.

Gas for industrial purposes is chiefly required for its calorific value alone; and therefore, in manufacturing centres, the old rule of enforcing a certain candle-power standard was often extravagant and futile. It is impossible for gas to compete successfully with other fuels until the cost of production is reduced to a competitive level. During the war an opportunity was given to show what gas could do, and it forged steadily ahead; but although in many instances the work was better, cleaner, and more quickly done, yet the question of expense often stood in the way of the installation of a gas appliance. Some of the economic properties of the gas installation only indirectly touched the pocket of the manufacturer; and there is no getting away from the fact that money is the deciding factor. Providing, therefore, gas can be produced at a cheaper rate, there lies a vast field ahead of it in the industrial world. By means of gas appliances it has been proved that there can be greater and quicker productivity, with less labour, less space, and greater efficiency and reliability, with fewer chances of accidents, and a minimizing of discomfort to those engaged in the work. Since all these are proved facts, and gas can be seen employed for industrial purposes of a vastly varied description in hundreds of factories and workshops all over the country, it only remains further to popularize it by reducing

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* "The Distribution of Fuel and Power Gas in Birmingham," by B. H. Thwaite, C.E., F.C.S., with supplement by Dugald Clerk. "Journal of Gas Lighting;" 1892.

† "Transactions Incorporated Gas Institute," 1902, p. 23.

its cost as far as possible—making it a commercial proposition within the reach of all.

Under the Gas Regulation Act, this appears more possible than it has been in the past. Up to the present, a certain candle power value has had to be maintained by all undertakings, which handicapped them in making a cheaper gas with a lower candle power but of good calorific value, which perhaps would have better suited their requirements. In some places where gas was not in demand for industrial purposes, the authorities did not feel the restriction; but in large manufacturing centres the handicap was often irritating and the cause of a great deal of friction and labour. The new Act, in allowing each district to be supplied with the kind of gas judged by those who make the gas to be that most suitable to the requirements of the neighbourhood, does at least give every gas undertaking a chance to prove what it can do in the interests of both the consumer and the supplier. The interests of both thus become more closely linked; and if adequate energy and enthusiasm are forthcoming, it is quite possible, with the liberty now afforded, for a sound effort to be made so to reduce the cost of production of gas that it can easily compete with solid fuel as a means of supplying heat for industrial purposes. The experience of the last few years has proved conclusively that a reduction in quality does not affect the value of the gas for the majority of purposes. An important factor to be kept in mind is that an adequate pressure must be maintained; otherwise lack of pressure will be attributed to the bad quality of the gas.

The point is, no matter what B.Th.U. value is being supplied—whether high or low—neither will be a success unless sufficient pressure is carried. In other words, pressure and volume run hand in hand. Particularly is this important in large industrial centres, where for a short period, when the lighting load comes on, the industrial and domestic loads overlap, with the consequence that a drop in pressure ensues.

The ordinary consumer does not grasp the position, and (as previously stated) lays the whole blame on the quality of the gas; and the only way to educate him to appreciate a lower-grade gas is to maintain a constant pressure. A way to obviate the difficulty is to lay a high-pressure main, and boost in at intervals, where necessary, to the existing mains. To augment the pressure at the works does not always meet the case, where outlying large industrial areas have developed rapidly. Gas sold to-day is used in entirely different circumstances and for purposes never thought of in the early days of the industry, or even (say) twelve years ago.

A logical conclusion therefore resolves itself into the question of the quality of gas that can be most economically made and distributed. In considering this point, development should proceed along the line of supplying a gas each cubic foot of which will as nearly as possible produce the same result to the consumer as at present, but at a reduced cost. Inextricably mixed-up with the problem of reducing the costs of the gas supplied—and one of almost equal importance—is the question of raising the efficiency of gas-consuming appliances and obtaining from each B.Th.U. consumed the maximum amount of effective heat. There exists, I think, a very wide scope for development in this direction. Generally speaking, the existing design of gas-fired furnaces, although a great improvement on solid-fuel furnaces, is still relatively inefficient; and if we are energetically to speed-up the future possibilities of the industrial load to anything like the dimensions desirable, very earnest thought must be given to the question of furnace design with a view to fuel economy. The source of heat leakage in many cases is so obvious that only a cursory examination of the design is sufficient to show the fuel-saving possibilities. For instance, the natural-draught under-fired oven furnace of the semi-muffle pattern is a well-known type. It consists of a row of atmospheric burners fixed longitudinally along the centre of the furnace, or with two rows of burners if the furnace is more than 3 feet wide. The flame strikes the underside of the floor and spreads outwards, rising into the heating chamber on each side of the furnace. The products of combustion pass out through flues built in the arch. The waste gases leave a furnace of this type at a temperature closely approximating that of the oven, and the brickwork below the furnace floor is heated-up to no useful purpose. It seems to me that in future the universal demand will be for furnaces equipped with scientifically proportioned recuperators and regenerators, and that not only the air but the gas also will be highly pre-heated before combustion is effected.

In addition to the quality of gas and gas appliance, it is necessary to ensure efficient service to the consumer. This is particularly important on the industrial side, which is the latest development of the gas industry, and yet practically in its infancy. Most undertakings have installed a special official to look after the interests of the industrial consumer; and where one has not yet been appointed, if this class of work is carried on to any extent, the present would be an opportune time in which to branch-out. Complaints are often received as to a deficient supply of gas which can be traced by an experienced man to the appliance itself, and not to the gas supply—as all too readily indicated by the complaint. It has not been an uncommon thing to find that the gas-pipes run to the gas-furnaces are altogether inadequate to give the quantity of gas necessary; and consequently the efficiency of the appliance suffers. An official, as suggested, can keep in touch with all classes of consumers, give advice on new installations, and see that everything is fitted-up satisfactorily, while on the completion of the work he can give hints as to the manner of working the appliance and how to obtain the best efficiency. In this way he is helpful, not only to the consumer, but to the undertaking on whose behalf he works, as he inspires in those with whom he comes in contact confidence in the utility and usefulness of gas and gas-appliances, and greatly helps to keep-down complaints.

I look forward with great confidence, and believe the achievements of the past, remarkable as they have been, will be greatly surpassed. The Gas Regulation Act has been conceived on right lines and with sufficient flexibility for whatever changes the future may bring. It will renew the confidence of manufacturers, and remove that feeling of suspicion and distrust which was created during the war, and which unfortunately still exists in some quarters. By popularizing gas as a fuel, it will undoubtedly be beneficial to the gas industry, and indeed to the whole community.

## GAS BILLS FOR 1921.

[FOURTH ARTICLE.]

THE review of the Gas Bills that have been lodged for consideration in the coming session is concluded to-day.

Further powers are sought by the WALTHAM ABBEY and CHESHUNT GAS AND COKE COMPANY. From the preamble of the Bill, it is gathered that the original capital amounts to £20,000; the additional capital, to £38,070. On the latter, £4695 10s. 1d. in premiums have been paid. The total raised is therefore £62,765 10s. 1d., out of the total authorized of £90,000. The borrowing powers amount to £30,000; and £17,750 is the sum issued. In the first place, the Company are proposing to shorten their name to the "Waltham and Cheshunt Gas Company." Lands are scheduled for new gas-works; and the necessary constructional, maintenance, and working powers are sought. To the works clause the now customary secondary products powers are appended. Additional capital authorization is desired to the amount of £60,000, with one-third borrowing powers. The Company seek for the removal of the limit of dividend on the existing authorized preference capital, and to leave the rate to the determination of the Directors at the time of issue. Sanction is asked to the raising of preference or debenture stock as redeemable. Reserve and special purposes funds powers are included. Annual meetings are provided for. It is also observed that the Company have produced a new stand-by clause, in the following terms:

> Where any person has for the purposes of a stand-by only a supply of gas laid on by the Company to any premises used for trade or business purposes for which he has at the same time a separate supply of electricity or gas for power or other purposes, the Company shall be entitled to charge and receive from him in respect of the supply of gas so laid on for each quarter of a year, and that notwithstanding that the ordinary charge for the gas supplied to such person in such quarter would amount to a lower sum, such minimum amount as may be fixed by the Company not exceeding the amount provided for by the following scale (that is to say)—
>
> | | |
> |---|---|
> | Where the service-pipe to such premises is of a diameter of 1 in. or less | £1 5 0 |
> | Where the service-pipe to such premises is of a diameter exceeding 1 in. and not exceeding 1½ in. | 1 17 6 |
> | Where the service-pipe to such premises is of a diameter exceeding 1½ in. and not exceeding 2 in. | 3 15 0 |
> | Where the service-pipe to such premises is of a diameter exceeding 2 in. and not exceeding 2½ in. | 5 12 6 |
> | Where the service-pipe to such premises is of a diameter exceeding 2½ in. | 7 10 0 |
>
> Provided that, in fixing the amount of such minimum charge, the Company shall have regard to the probable maximum supply of gas which might at any time be required for such premises.

Profit-sharing is provided for; and power to apply for Electricity Orders is included. There are a large number of miscellaneous clauses of general form. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

The WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS Bill proposes to make provision for the transfer of the Sutton Gas Company's undertaking. The preamble states that the prices now charged for gas are 4s. 2d. within the Wandsworth limits, 4s. 9d. within the Wimbledon limits, and 5s. 2d. within the Epsom limits. The price charged by the Sutton Company was during the past half-year 4s. 6d. in Sutton and Cheam (except Worcester Park), and 5s. within Worcester Park and Banstead. On Jan. 1 these prices were increased to 4s. 9d. and 5s. 3d. respectively. It is also seen that the issued capital of the Sutton Company now consists of £133.571 of consolidated ordinary stock, which is entitled to a standard dividend of 5 p.ct. per annum, subject to the operation of the sliding-scale. The Company have also raised by the issue of mortgage debentures, bearing interest at the rate of 6 p.ct. per annum, the sum of £26,825. The area within which the Sutton Company are at present supplying gas lies between the Wimbledon limits and the Epsom limits of the Wandsworth Company; and the Sutton Company have agreed to sell (so the preamble says) their undertaking to the former on terms set out in the Bill. The standard price of gas in the

Wimbledon limits of the Wandsworth Company is the same as the Sutton standard price of gas, and the standard dividend and sliding-scale applicable to the Wimbledon stock are also the same. The Wandsworth Company are, it is mentioned, making application to the Board of Trade for new standard prices on the therm basis. Another matter is being dealt with in the Bill. By section 55 of the Wandsworth Company's Act, 1912, they are obliged to charge in the Wimbledon limits 7d. per 1000 c.ft., and in the Epsom limits 1s. per 1000 c.ft., in excess of the price charged in the Wandsworth limits. But the cost of the production and supply of gas in the Wimbledon and the Epsom limits is not so much as 7d. and 1s. respectively in excess of the cost of production and supply in the Wandsworth limits, and so the provisions of the section operate harshly on the consumers of gas in the Wimbledon and Epsom limits, and on the holders of the Wimbledon and Epsom stocks. To remedy this is one of the objects of the Bill. Turning to the clauses, the first provisions that interest are those referring to the Sutton transfer, and the dissolution of the Company. It is proposed that, as soon as practicable from the date of transfer, the Wandsworth Company shall issue to the holders of consolidated ordinary stock of the Sutton Company an equal amount of ordinary stock (entitled to a standard dividend of 5 p.ct.) of the Wandsworth Company to be called the Sutton stock. The Company will also take over the Sutton debenture obligations. It is provided that one of the Directors of the Sutton Company shall become a Director of the Wandsworth Company, which will temporarily increase the number of Directors to eleven. No vacancy which may occur on the Board—after the date of transfer—by death, resignation, or vacation of office (otherwise than by rotation) is to be filled up until the number of Directors is reduced to seven; and thereafter the number of Directors is not to be less than four nor more than seven. Within a month after the transfer, the Directors of the Sutton Company are to receive £8333 as compensation for loss of office other than to the one joining the Board of the Wandsworth Company. Each Auditor is to receive £300. To Mr. Stephen Carpenter, the Resident Engineer and Manager of the Sutton Company, a retiring allowance is to be paid at a rate equal to the average amount of salary and emoluments received by him during the three years ending Dec. 31, 1920; or, if desired by him, the Company shall alternatively pay him a capital sum based on the value of such retiring allowance for the remainder of his life calculated on the Carlisle Tables of Mortality. Provision is also made for the compensation of other officers whose services are dispensed with by the Wandsworth Company. The Sutton reserve fund is to be added to the reserve fund of the Wandsworth Company, and the insurance and renewal funds will be added to the special purposes fund of the latter. The standard price within the Sutton limits (except Banstead and Worcester Park) is to be the same per therm as may be authorized for the Wimbledon area. In Banstead and Worcester Park, it is proposed that the price per therm shall be equivalent to 6d. per 1000 c.ft. in excess of the price from time to time charged for gas supplied within the remainder of the Sutton limits; but any sum so charged in excess shall not be taken into account in calculating the rate of dividend on the Sutton stock. Then comes the amendment of the proviso to section 55 of the Wandsworth Act of 1912. It is proposed that the actual price charged for gas within the Wimbledon limits shall not exceed by more than 5d. per 1000 c.ft. (or its equivalent per therm), and the price within the Epsom limits by not more than 10d. per 1000 c.ft. (or its equivalent per therm), the price within the Wandsworth limits. After the Act is passed, increases or decreases of price are to be the same throughout the entire limits of supply. It is also provided that the Board of Trade may revise the differences of charge between the Wandsworth and the Wimbledon and Epsom areas, if required to do so by the Company. The Company ask for the repeal of their powers of raising the unallocated capital authorized by the Act of 1912; and this is followed by authorization to raise from time to time additional capital not exceeding in the whole £310,134 5s. 3d. (being the total amount of the unissued authorized capital of the Wandsworth and Sutton Companies) by the creation and issue of Wandsworth 5 p.ct. "A" stock or preference stock. It is proposed that the borrowing authority of the Company shall be extended to one-half of the issued capital. Works and secondary products powers on the lands at Epsom are included in the Bill. [*Parliamentary Agents: Messrs. Lees & Co.*]

A part of the WIGAN CORPORATION Bill proposes the usual powers as to the specification of pipes and fittings on a consumer's premises between the Corporation mains and the meter; and power is also sought to lay pipes in private streets. Among the borrowing powers, £20,000 is desired for gas mains, plant, and other purposes in connection with the gas undertaking, with a period of repayment of thirty years. A clause in the financial section is to authorize the Corporation (if they think fit) to apply money received by them on account of the revenue of any of their trading undertakings to the construction, extension, and improvement of the works and conveniences for the purpose of such undertaking, and to the provision of funds for working capital, subject to the money being only so applied after working and establishment expenses of the undertaking and the interest and working capital fund payments have been provided for. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, & Co.*]

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Through a Provisional Order for which application is being made to the Secretary for Scotland, the DUNDEE GAS COMMISSIONERS are proposing to acquire further lands for the making, storing, and distribution of gas and secondary products. Existing borrowing powers are to be made applicable to the new proposals. [*Parliamentary Agents: Messrs. W. Robertson & Co.*]

The GLASGOW CORPORATION, also by a Provisional Order, are asking for power to borrow £3,000,000, in addition to the £3,087,268 authorized to be borrowed by the Acts of 1910 to 1915; and they ask that they "may again borrow any part of the said sum of £3,000,000 which may have been repaid by them, otherwise than by the application of moneys received for lands and properties sold by them, and by sinking fund provided by the Gas Acts and this part of this Order." A sinking fund is the subject of the next section. The Corporation also propose to relieve themselves of the obligation to appoint a gas treasurer for the purposes of the Gas Acts, and to be empowered to "authorize any of their officers to exercise the powers conferred on, and discharge the duties appointed to be performed by, the treasurer under the said Acts." [*Parliamentary Agents: Messrs. Martin.*]

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## ELECTRICITY SUPPLY MEMORANDA.

NOT before inquiry is wanted, Dr. Addison has appointed a Committee to investigate and to report upon the reasons for the high cost of building working-class dwellings, and to make recommendations as to any practicable measures for reducing the cost. We can suggest one where the housing authorities are municipalities owning electricity supply undertakings. Some of them are spending thousands of pounds in the laying of cables for the meagre amount of light that will be required per dwelling, while the local gas suppliers have also to spend money in laying mains for the cooking and heating services, and from the same gas-mains the lighting could be done (without the expenditure on electric cables, services, meters, &c.) by small consumption incandescent gas-burners. The mantles in use are also of lower intrinsic brilliancy than incandescent electric lamps, and therefore less harmful to the eyes of the tenants, who will not be of the class who can afford expensive fittings for eye protection. Moreover, it is becoming more and more obvious that these electric-lighting schemes for such dwellings cannot pay; and some local authorities are in consequence wisely deciding to cut-out the electricity part of their schemes. Lincoln is an example. The estimated capital cost of installing electricity for lighting in 432 houses is £11,500; the estimated annual charges, including the cost of producing the current and incidental expenses, is £2000; and the estimated annual revenue is only £1000 per annum. This means a dead-loss of £1000 per annum. It was stated in the Council recently that the Commissioners were not prepared to give a guarantee for more than three years of a reasonable return on the capital involved; and the Housing and Town Planning Committee therefore passed a resolution to discontinue the wiring of the houses, and recommending that electricity be not installed. Notwithstanding the evidence of the estimates, there were members of the Council who wished to have the matter referred back for reconsideration. Are these typical of the men who are by wasteful expenditure bringing municipal government into disrepute? Fortunately they were defeated; and the ratepayers are saved this burden. We see, too, that at Bath the City Council have decided not to introduce electricity into the housing scheme [see *ante*, p. 112]. Economy has also led the Chichester Council to adopt an amendment to a proposal of the Housing Committee that electricity be used for lighting; and gas will now be used for both cooking and lighting. Other councils are going forward with applications for loans for the purpose. The Beckenham Council are applying for a loan of £5700 for cable extensions and house wiring for their housing scheme. At Wrexham, the cost of cables, &c., is estimated at £11,700. It has been decided by the Council to apply for this sum, in addition to £3000 in respect of expenditure in excess of loans already sanctioned. Before loans are allowed, these and other electricity schemes for artizan dwellings ought to be closely investigated to see what they are likely to involve financially.

**Housing Schemes and Intelligent Decisions.**

**Stupid Allegations.**

Of course, the electrical journalists are rampant over the position into which electricity is falling in this matter. The truth will out; and local authorities are beginning to scent danger ahead with rates what they are, and ratepayers incensed. Some very silly things are being said in reference to the matter. The "Electrician" the other day was speaking of the "fallacy" that electricity is so expensive. Of course it is quite easy to write the word "fallacy;" but it is not always so easy to prove that the matter so described deserves the epithet. Experience of installation expenses, the cost of appliances, and running charges do not support our contemporary. It is a little bit chagrined over the recommendation of the Ministry of Health that electricity should only be used for purposes other than lighting where gas cannot be coveniently obtained. The Ministry, our contemporary writes, "quite overlook the fact that in dealing with this important question the total cost must in every case be considered, and not simply either the capital costs or the working expenses of installing or using any particular heat agent as separate items." There is

agreement; and, on the ground of total cost for the main domestic purposes, we are quite prepared in the name of gas to join issue with our contemporary, if it will depart from cheap generalities to discussable particulars. There are other statements which we are sorry to see our contemporary makes without the support of a shred of evidence, and until it shows the evidence, we prefer to regard the statements as shallow fabrication. It asserts that gas authorities are quoting such low installation costs that electricity cannot economically compete. If they are doing this, the housing authorities and the future tenants ought to be very much obliged to them. But we have not come across quotations that are anything more than reasonable and fair. Gas undertakings are not, and never have been, philanthropic bodies; they have to work upon profitable lines, and not give things away. The fact of the matter is the "Electrician" is foolishly measuring gas costs in the electrical bushel, and finds they do not fill the measure. We should like our contemporary to quote instances of these "low" costs, and give particulars of what is included in them. Then comes another piece of empty assumption or pure fabrication. "It should be obvious," writes our contemporary, "that those supplying gas must recoup themselves somehow, and will do so by charging the tenants an excessive price for the gas consumed—in other words, what the building authority saves, the tenants will lose." Perhaps our contemporary will explain how the gas suppliers can charge the tenants an "excessive" price for gas, when the price is regulated by Act of Parliament, and so is the hire of fittings in prepayment installations. The gas authorities cannot charge the tenants of these houses anything more than they are charging to the ordinary consumers, *plus* (if the prepayment system is worked) a charge for fittings' hire, the maximum figure for which is fixed in every Gas Act in which the powers of supply under this system exist. Though things are working out somewhat short of the mark the electrical people made for themselves, they need not render the position worse for themselves by the employment of statements that are untrue and easily refutable.

**Coincidence of View!**

The remarks to which we have drawn attention were made by the "Electrician" on Jan. 14. On Jan. 7, the "Electrical Review" wrote as follows: "We may remark that the use of electricity in connection with many of the new housing schemes is hindered by the low prices quoted by the gas suppliers for equipment, doubtless with the intention of recouping themselves by way of charges for gas." The dates are interesting, and so is the coincidence of suggestion. What we have said of the "Electrician" will apply to the "Electrical Review," with a little credit to the latter for not making itself look so absurd, by adopting a little more moderation in referring to the recouping part of the process.

**Installation Costs.**

A correspondent of the "Electrical Review" complains of the high costs of making a ten-point installation in a small villa about 20 ft. back from the road, in which mains are already laid. The electricity suppliers are a District Council; and the cost they quoted for their part of the work is £15. Together with the wiring, the cost of the whole installation would have been about £41, which the writer thinks quite prohibitive. Electric lighting has not been adopted. In the view of the correspondent, if similar charges are being made throughout the country, the immediate future of electric lighting would be very gloomy. We have seen several estimates ranging from 40s. to 50s. per point for interior work.

**Inferior Metallic Filament Lamps.**

Another correspondent of the paper complains of the inferior character of the metallic filament lamps now being placed on the market. He had good experience of pre-war lamps; but he is now no believer in the legend that the life of such lamps should be 1000 hours. The letter continues: "I have tried all the leading makes; and I should imagine that 250 hours average is about the maximum one can expect from lamps purchased in the last twelve months. As for the half-watt type, these are infinitely worse. I purchased eight ten days ago—six burnt out in three days, and were returned to the factors who supplied them, who also tendered the information that they were having a tremendous number of complaints, and having to return lamps to the makers in hundreds. Besides concentrating on prices, could not the lamp ring make an effort to see that a consumer gets a fair return for his money, and by so doing help the electrical industry generally? The failures referred to are not mechanical breakages, but lamps which go out after a short run in perfectly undisturbed positions." This is not a good testimonial; and the experience of users will not, by its circulation, assist the expansion of electric lighting. We have in mind a shopping street in which last October half-watt lamps predominated in the windows of the electrically lighted shops. Some of the shopkeepers have returned to ordinary metallic filaments.

**A Bad Start.**

The Electricity Commissioners journeyed to Bristol for the first inquiry (which it had been heralded would open on Jan. 11) under the Electricity Supply Act, 1919, into the formation of a Joint Electricity Authority for the Lower Severn District. They soon had their bags repacked, and were quickly back in town. The Commissioners present were: Sir John Snell, Sir Harry Haward, Mr. H. Booth, and Mr. Archibald Page; their Legal Adviser, Mr. E. W. Hudson; and their Clerk (Mr. D. S. Cumberlege). Local authorities and private enterprises were represented in abundance. But the ground had not been prepared as the Electricity Commissioners had hoped and expected. In the first place, the Organizing Committee were not represented by Counsel as Sir John Snell had anticipated they would have been; and therefore he had to call upon Mr. H. Faraday Proctor, the Chairman of the Committee, to open the case. He informed him that he would also have to take the part of witness, and submit himself to cross-examination by those representing other interests. This, Sir John pointed out, was not an altogether helpful way of doing things, and might cause confusion. Mr. Faraday Proctor had not proceeded far in his opening when he mentioned that it was considered undesirable (indeed impracticable) for a Committee who were not regularly constituted, and had not time or means at their disposal, to undertake specific detailed investigation of the engineering problems, more particularly having regard to the fact that the area had not been finally determined. There the Committee had fallen short of its responsibilities and opportunities. Sir John Snell inquired how it came about that the district was in this position, when to the knowledge of the Commissioners other districts had submitted schemes and full engineering particulars. Corporations and companies could not possibly criticize the proposals of the Organizing Committee unless the engineering particulars were at their disposal. They ought to have something upon which to proceed. Disappointment was expressed that the Committee had not the information available for distribution to the various representatives. The views of Sir John were endorsed by several of those present. Thereupon it was agreed, in order that all available information might be placed in the hands of those concerned, to postpone the inquiry until March 1. Perhaps little hitches must be expected at the start; but other Organizing Committees will profit by the experiences of that for the Lower Severn area.

## NEUTRALIZING AND DRYING SULPHATE OF AMMONIA.

### Amendment of a Patent.

WHEN the paper by Mr. E. V. Evans, O.B.E., F.I.C., of the South Metropolitan Gas Company, on "The Manufacture of Neutral Sulphate of Ammonia," was under discussion at the last meeting of the Southern District Association of Gas Engineers and Managers [see "JOURNAL," Dec. 1, 1920, p. 515], Dr. Lessing made these remarks:

> He was particularly struck, and he thought all present must have been, by the fairness with which Mr. Evans had mentioned the process as being only one in a chain of a number of processes by other workers. Mr. Evans had mentioned his (Dr. Lessing's) name as having been engaged on the subject; and he thought they must all be grateful to him for the fairness with which he had put before them, and indicated the claims of, the other processes—more particularly since some of those present might not know that certain proceedings were pending in connection with the patents, into which he should not like now to go. But he might say that he could almost claim that, during the whole period during which the processes had been worked out, he had been in touch with Mr. Evans on these problems. As a matter of fact, if he told them that the first batch of neutral dried sulphate was made more than two years ago by the Company with whom he (Dr. Lessing) was connected, the members would sympathize with the "small fry" that had to work out the process by depending on the facilities and goodwill of others—the engineers in smaller works—to get the process established; while the big, enterprising concerns they had (such as the South Metropolitan Company) had been able to turn the whole of their very efficient staffs and resources to the problem which they rightly recognized as a most important one; and they could come before them that day with an accomplished process.

In his reply to the discussion, Mr. Evans, referring to Dr. Lessing's remarks, stated that this was the first indication he had had of any sort of proceedings pending; and he could only imagine that some appeal had been made to the Patent Office to reduce the claims the [South Metropolitan] Company made in their patent specifications. Throughout the whole paper, he had not dealt with the question of priority.

In the "Patent Journal" for Jan. 12, the following notice appeared of amendments made and references inserted as a result of the extended investigation under section 8 of the Patents and Designs Acts 1907 and 1919: "Amended by way of Disclaimer 141,798, South Metropolitan Gas Company and others." Patent No. 141,798 is the one granted to the Company, Mr. Evans, and Mr. H. Hollings; and it describes the process of neutralizing and drying sulphate of ammonia. An abstract of the original specification appeared in the "JOURNAL" for May 25 last, p. 438. Apparently this is the matter to which Dr. Lessing referred in the Southern discussion; and it appears to point to a satisfactory settlement of any question there may have been as to priority.

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A local correspondent informs us that the Derby Corporation have retained Mr. John Bond, of Southport, in connection with the application of the Derby Gas Light and Coke Company, under section 1 of the Gas Regulation Act.

# THE POSSIBILITIES OF GASEOUS HEATING.

By W. NEWTON BOOTH, Assoc.M.Inst.C.E., B.Sc., of the Royal Arsenal, Woolwich.

**[A Paper read, with the Aid of Lantern Slides, before the London and Southern District Junior Gas Association, Jan. 21.]**

## INTRODUCTION.

One of the greatest changes which has come over the conditions under which the modern gas industry operates is due to the substitution of heating for lighting as the principal use to which its main commodity is put. It has led to the substitution of a calorific for an illuminating power standard of quality; and this has occasioned drastic changes in the operation of the works plant, and also, as was so clearly shown in Mr. Lacey's paper of a month ago, has had an important bearing on the distribution system. The load factor on the undertaking has much improved as a result, with consequent advantages in the economical production of gas, mainly as a result of the increase in the use of gas for heating and cooking leading to heavy day—and especially much heavier summer—loads than were formerly the case. But now that such loads are not only filling-up the time when lighting loads are at their lowest, but are tending to take the most important position in the load curve (as anyone who has to cater for the Sunday dinner-time load in a residential district realizes only too well), it is good to remember that such excellent gas consumers as cookers and fires, to say nothing of geysers, have a very poor load factor, and that an undertaking whose principal consumption went for these purposes would be likely to make its load factor worse by every such extra appliance coupled to the mains.

It appears desirable, therefore, to develop the consumption of gas in such a way as to counteract this tendency; and, in my opinion, the use of gas for industrial heating offers possibilities which have as yet hardly been touched. In practically every industry there have to be performed certain operations requiring the application of heat—often with great nicety of temperature regulation, and the maximum freedom from dirt and dust; and for such purposes town gas offers a medium which is at once efficient and convenient. Such operations are carried out for fairly long and regular periods both summer and winter, and so have a load factor high enough very substantially to improve that of most gas undertakings. It should be said at once that only as town gas can offer a commercially economical service for such operations, and can show an all-round saving in working costs, will it be able to hold its own in this field; and it is my object to consider for a short time what are the possibilities of gas for these purposes in competition with older and newer methods.

## COMPETITORS OF GAS.

The principal competitors are solid fuel (such as coal and coke), home-made gaseous fuels (such as the various producer systems), oil, and electricity. Solid fuels, chiefly owing to the necessity of using a large excess of air in order to secure complete combustion, can only be operated at a relatively low efficiency whenever high temperatures have to be attained. Its use involves considerable dust, and trouble in the disposal of ashes; while the storage of the necessary fuel occupies valuable space, and necessitates the locking-up of capital. Home-made fuel gases are only economical where installations of sufficient size to justify the employment of the necessary labour are possible; and they have some of the disadvantages of solid fuel as regards dust and storage. Oil needs special arrangements for its storage, with some risk of fire; while at present prices it is by no means a cheap fuel. Town gas has the advantages of being clean, of a regular supply of constant quality being always available—a by no means negligible factor, when the success of an operation depends on regular and dependable heating—of requiring no storage, of generally being supplied on long credit, and of being capable of use with relatively high thermal efficiency in simple and cheap furnaces which require the minimum floor space, and give generally a high output compared with solid-fuel furnaces. These advantages have to be placed against the relatively high cost of town gas per therm supplied; and for most work on installations which are not large enough to warrant the installation of producer-gas furnaces, town gas is, on the whole, the best and most economical agent. Electricity is relatively a very expensive source of heat; and except where the special advantages of electrical heat are worth considerable extra expenditure on fuel, or where very high temperatures are required, it is not a very serious competitor for industrial heating.

The abundant supplies of cheap fuel available in this country before the war rendered it unnecessary to pay very careful attention to the use which was being made of the heat generated by its consumption; and consequently, except for steam-raising and for those industries where the consumption of fuel was the largest item of expenditure, thermal efficiency of operation was treated as a relatively unimportant matter, and the fuel efficiency of industrial furnaces was very low indeed. Shortage of fuel and increasing cost have necessitated a more careful study of this matter; and I am glad to say that already much improvement has been effected by the application of scientific methods to the design and operation of furnaces.

## POSSIBILITY OF INCREASING THERMAL EFFICIENCY.

The heat generated by the combustion of fuel in a furnace is expended in three main directions. First, in the useful work of raising the temperature of the articles to be heated; secondly, in maintaining the supply of heat to the walls of the furnace, to make-up for that lost therethrough by conduction and radiated from the outside surface into the workshop; and, thirdly, in maintaining the temperature of the flue gases. The proportion used in useful work expresses the thermal efficiency of the furnace; and this figure is important, as being the determining factor in the amount of fuel required to perform a certain amount of work—that is, of the fuel cost of the furnace. It is the possibility of increasing the thermal efficiency of industrial furnaces that I wish to consider next.

Table I. has been prepared from information obtained from various sources, and shows the distribution of the heat of the fuel in some different types of commercial furnaces. It indicates what an extremely low efficiency was obtained from the early type of small gas-furnaces, and that a very distinct improvement has been made, culminating in a thermal efficiency of over 50 p.ct. obtained in a large furnace where the walls were specially constructed to resist the passage of heat, and where the heat of both the flue gases and of the work leaving the furnace were used to the full for the purpose of preheating the air and gas used for combustion. In comparing the percentage of heat lost through the walls and in the flue gases, it should be remembered that, though the saving does not appear to be very high, a furnace with a high thermal efficiency is using a very much smaller total amount of fuel; and therefore a loss of (say) 50 p.ct. in the case of a furnace having a thermal efficiency of 10 p.ct. is, in actual thermal units lost, only half that in the case of a furnace of 5 p.ct. efficiency, and so on.

## FURNACE OPERATIONS.

In considering this question more fully, it is first necessary to inquire precisely what happens during the operation of a furnace. Starting with the fuel and air for its combustion, these enter the furnace, and, in those furnaces where recuperation of the waste heat is attempted, are heated by such heat to some temperature less than that of the furnace, and are then allowed to enter the combustion chamber, when combustion takes place liberating heat. In most cases a small proportion of this heat is radiated from the flame directly, but by far the largest amount is used in raising the temperature of the flame gases. These, by reason of their higher temperature, give up heat to the furnace contents and walls, and are cooled thereby to some lower temperature (but one which is necessarily higher than that of the walls, &c.), and leave the furnace proper to enter the recuperator, where they give up heat, which is transmitted to the incoming gases, and finally leave the furnace at some temperature higher than that of the incoming gases. As we shall find later, one of the governing factors in this transfer of heat is the degree to which the furnace gases are heated; and in order to preserve a convenient sequence, this question will be considered.

## DEGREE OF HEATING OF FURNACE GASES.

All fuel gases consist of mixtures in various proportions of a relatively small number of simple gases. Table II. shows the

TABLE I.—*Efficiencies of Furnaces.*

| Type. | Fuel Used. | Work Done. | Working Temperature. °C. | Heat Account. | | | Remarks. |
|---|---|---|---|---|---|---|---|
| | | | | In Work. | Through Walls. | In Flue Gases. | |
| | | | | P.Ct. | P.Ct. | P.Ct. | |
| Small oven | Coal gas | Tool hardening | 900 | 5·0 | 55·0 | 40·0 | Natural draught. |
| ,, | ,, | ,, | ,, | 10·0 | 43·5 | 56·5 | Pressure gas. |
| ,, | ,, | ,, | ,, | 30·0 | 53·3 | 16·7 | Regenerative. |
| ,, | ,, | ,, | ,, | 35·0 | 48·0 | 17·0 | Recuperative and with lagged walls. |
| ,, | Oil | Blanks for drop stamping | 1200 | 9·0 | 44·0 | 47·0 | |
| ,, | ,, | ,, | ,, | 18·0 | 52·0 | 30·0 | Recuperative. |
| Crucible | Coal | Melting nickel alloy | 1400 | 17·0 | 23·0 | 60·0 | Pressure gas. |
| ,, | Gas | ,, | ,, | 35·0 | 45·0 | 20·0 | Recuperative and lagged walls. |
| ,, | Coke | ,, | ,, | 7·0 | 14·0 | 79·0 | |
| ,, large | Producer gas | Steel | 1500 | 14·8 | 47·3 | 32·4 | Regenerative. |
| Pottery oven | ,, | ,, | 1200 | 52·3 | 41·9 | 5·8 | Specially designed and fully regenerative. |

principal physical properties of these. Possibly a word of explanation of the various terms is necessary. When any chemical reaction (of which combustion is but a special instance) takes place, it is general to find that the internal energy of the substances existing before and after the reaction are different; and the difference is shown by the appearance or disappearance of a definite amount of energy, usually in the form of heat. In the case of combustion, the reaction is always accompanied by the evolution of heat. So long as the final products are the same, this heat is constant in amount, no matter by what means the actual combustion has been effected; and the amount of heat liberated when a unit amount of the substance is completely burnt, and the products cooled-down to the original temperature, is known as the calorific value of the substance. When the original substance contains hydrogen, water vapour is produced by its combustion; and the calorific value differs by the amount of its latent heat, according as the vapour is condensed to liquid form or remains as vapour in the flue gases. The higher value is known as gross, and the lower as net value. In the table, the values are given in pound-centigrade heat units, each of which is equal to 1·8 B.Th.U.

TABLE II.—*Calorific Properties of Pure Gases.*

| Substance. | Air Required for Combustion. | | Calorific Value. | | | | Cal. Intensity. |
|---|---|---|---|---|---|---|---|
| | | | Per 1 Lb. | | Per C.Ft. | | |
| | Per Lb. | Per C.Ft. | Gross. | Net. | Gross. | Net. | |
| Carbon to CO | 5·8 | .. | 2,453 | .. | .. | .. | 1485 |
| ,, $CO_2$ | 11·6 | .. | 8,137 | .. | .. | .. | 2753 |
| Carbon monoxide | 2·48 | 2·38 | 2,436 | .. | 190 | .. | 2430 |
| Hydrogen | 34·8 | 2·38 | 34,500 | 29,150 | 193 | 163 | 2200 |
| Methane | 17·4 | 9·54 | 13,343 | 12,006 | 595 | 535 | 2010 |
| Ethane | 16·48 | 16·7 | 12,410 | 11,340 | 1063 | 973 | 2008 |
| Ethylene | 14·9 | 14·3 | 12,182 | 11,418 | 969 | 909 | 2240 |
| Benzene | 13·38 | 35·8 | 10,052 | 9,612 | 2092 | 2002 | 2150 |
| Acetylene | 13·38 | 11·93 | 12,142 | 11,732 | 903 | 873 | 2630 |

The calorific intensity is obtained by dividing the calorific value (net) by the heat capacity (weight × specific heat) of the products of combustion, and gives the temperature range through which this heat would raise these products if all the heat were expended in this way. The figure is useful as giving a rough measure of the amount of heat the furnace gases can give up in the furnace as:

$$\text{Fraction of Heat given up} = \frac{\text{Calorific Intensity} - \text{Temp. of Furnace}}{\text{Calorific Intensity.}}$$

From this, it will be seen that, other things being equal, a fuel having a high calorific intensity will give a higher efficiency than one with a lower intensity. It should also be noticed that the above fraction decreases very rapidly as the temperature of the furnace increases—a fact of very great importance in considering the attainment of high temperatures. It will be noticed from the table that carbon monoxide and hydrogen, both the simplest and cheapest constituents of fuel gases, have high intensities compared with the light-giving hydrocarbons; and for furnace work there is no need to strive after retaining such hydrocarbons. The case of acetylene is quite exceptional; but on account of its price, it is not a competitor, except for special purposes.

Table III. gives the composition of a number of the commoner fuel gases, from which the table of calorific properties has been calculated. The coal gas given was, as you will notice, of pre-war quality; but this will only affect its calorific value as compared with a modern gas, leaving the calorific intensity at approximately the same figure. From this table it will be seen that the producer gases are not much behind in the value of their calorific intensity, owing to their relatively low air requirements; so that coal gas cannot claim much advantage in this respect, as far as efficiency attainable is concerned.

When any of the above gases is burned in air, the products (after the reaction is completed) consist of steam, carbon dioxide, and nitrogen. Such completion of combustion is, however, not possible at the temperatures attained in the combustion zone, owing to the fact that both steam and carbon dioxide dissociate at high temperatures. A considerable amount of experimental work on this question has recently been done, and fairly accurate values obtained for the amount of dissociation which takes place.

If we think of the reaction as being expressed by the equations—

$$2H_2 + O_2 \rightleftharpoons 2H_2O$$
$$2CO + O_2 \rightleftharpoons 2CO_2$$

and proceeding in both directions until some equilibrium is established, when the amount of $CO_2$ or $H_2O$ dissociating into its constituents is equivalent to the amount of those constituents which re-combine in the same time, it can be shown that the equilibrium is affected not only by the temperature, but also by the concentration of the substances participating in the reaction. This is expressed mathematically by—

$$K_c = \frac{[H_2] \times [O_2]}{[H_2O]} + K_c = \frac{[CO] \times [O_2]}{[CO_2]}$$

where $K_c$ is the equilibrium coefficient and $[H_2]$, $[O_2]$, $[H_2O]$, $[CO]$, $[CO_2]$ represent the concentrations in gram-molecules per litre of the constituent in question. If x is the fractional dissociation, this reduces to—

$$K_c = \frac{P\,x^3}{RT\,(2+x)\,(1-x)^2}$$

where P is the partial pressure in atmospheres, T is the absolute temperature, and R is the gas constant.

Expressions for the relation between the numerical value of K and the temperature have been worked-out; and from these the curves shown on fig. 1 have been calculated, showing the percentage dissociation of both water vapour and carbon dioxide for various partial pressures and temperatures—such partial pressures being chosen to agree with those actually found in the gases from the combustion of common fuels. It will be seen that, at the temperatures which are commonly found in furnace gases, this dissociation is considerable; while at higher temperatures only a relatively small proportion of the fuel can be consumed until some heat has been abstracted from the gases. It should be remembered that these equilibrium figures represent limiting conditions, and it is probable that in practice such equilibrium is not reached in the time available for combustion, and the actual amount of dissociation is higher than that shown.

### PREHEATING AND FLAME TEMPERATURE.

Such considerations limit the temperatures it is possible to attain with gaseous combustion. It is possible, by pre-heating the air and fuel gas, to increase the amount of potential energy of the gases; but this does not mean a corresponding proportional increase in the temperature attained in the flame. In order to calculate this, it is necessary, besides knowing the dissociation of the products of combustion, to know also their specific heats at high temperatures.

Figs. 2 and 3 show the latest results of such measurements n the case of the gases usually found in furnace practice. It will be noticed that the specific heats of all gases increase very much at high temperatures; the curved form of the lines for carbon dioxide and water vapour being probably due to the dissociation already referred to.

With this information, one may proceed as follows to calculate the amount of preheat necessary to obtain any desired flame temperature in the furnace. Having calculated the proportion and partial pressure of the constituent of the products of combustion, determine the degree of dissociation from fig. 1, and calculate the actual composition of the flame gases. From this and the information in figs. 2 and 3 calculate the heat content of these gases, and add to this the calorific value of the unconsumed hydrogen and carbon monoxide. This gives the total energy of the furnace gases; and subtracting therefrom the calorific value of the original fuel leaves the amount of heat which must be supplied as preheat. From this, and the known weight of the fuel gas and air, and the diagrams of specific heats, calculate the temperature to which they should be preheated to contain this heat.

The information shown diagrammatically in fig. 4 has been calculated in this way, and shows the relation between the degree

TABLE III.—*Composition, &c., of Common Fuel Gases.*

| Gas. | A.B.C. Gas. | Natural Gas. | Coal Gas. | Carburetted Water Gas. | Blue Water Gas. | Producer Gas. Steam Jet. | Producer Gas. Ordinary Draught. | Mond Gas. | Blast Furnace Gas. | Oil Gas. |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentage composition of— | | | | | | | | | | |
| Hydrogen | 28·7 | 2·0 | 47·9 | 40·2 | 46·3 | 14·0 | 10·2 | 24·8 | 1·5 | 31·6 |
| Methane | 6·22 | 95·2 | 32·6 | 16·8 | 1·3 | 2·2 | 2·2 | 2·3 | 0·0 | 46·2 |
| Olefines | 0·65 | 0·5 | 3·5 | 8·7 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 17·0 |
| Benzene | 0·25 | 0·0 | 1·3 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| Oxygen | 0·0 | 0·0 | 0·2 | 0·1 | Trace | Trace | Trace | Trace | 0·0 | 0·0 |
| Nitrogen | 1·38 | 0·0 | 6·9 | 5·4 | 4·3 | 56·78 | 60·9 | 46·8 | 65·2 | 5·05 |
| Carbon monoxide | 62·5 | 1·0 | 6·1 | 28·7 | 45·6 | 23·0 | 24·2 | 13·2 | 27·3 | 0·15 |
| Carbon dioxide | 0·3 | 1·3 | 1·5 | 0·0 | 2 1 | 4·0 | 2·5 | 12·9 | 6 0 | 0·0 |
| Sulphuretted hydrogen | 0·0 | 0·0 | 0·0 | 0·0 | 0·4 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| Calorific value { Centigrade | 214 | 517 | 338 | 316 | 168 | 78 | 74 | 77 | 54 | 502 |
| Calorific value { B.Th.U. | 385 | 931 | 608 | 569 | 302 | 140 | 133 | 139 | 97 | 904 |
| Air for combustion | 3·13 | 9·47 | 5·875 | 5·22 | 2·37 | 1·117 | 1·05 | 0·983 | 0·702 | 9·01 |
| Calorific intensity { ° C. | 2210 | 1910 | 1997 | 2045 | 2150 | 1590 | 1580 | 1715 | 1275 | 2240 |
| Calorific intensity { ° Fahr. | 3978 | 3438 | 3595 | 3681 | 3870 | 2862 | 2844 | 3087 | 2295 | 4032 |

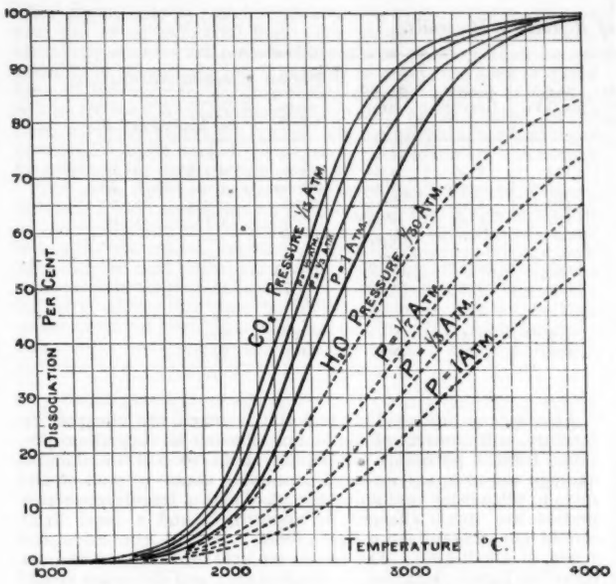


Fig. 1.

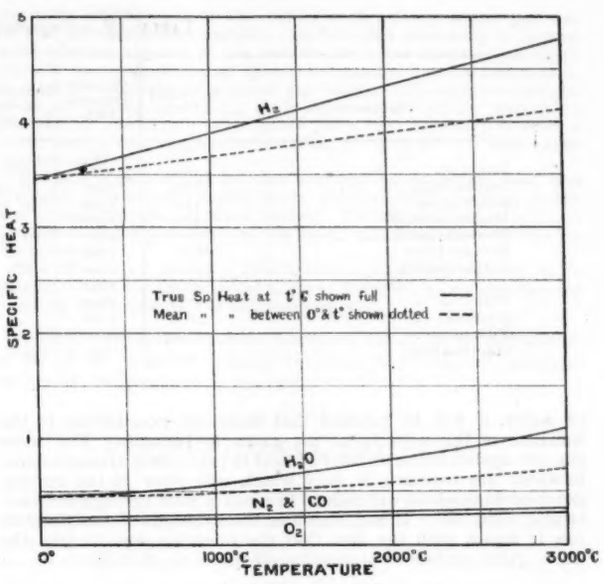


Fig. 2.

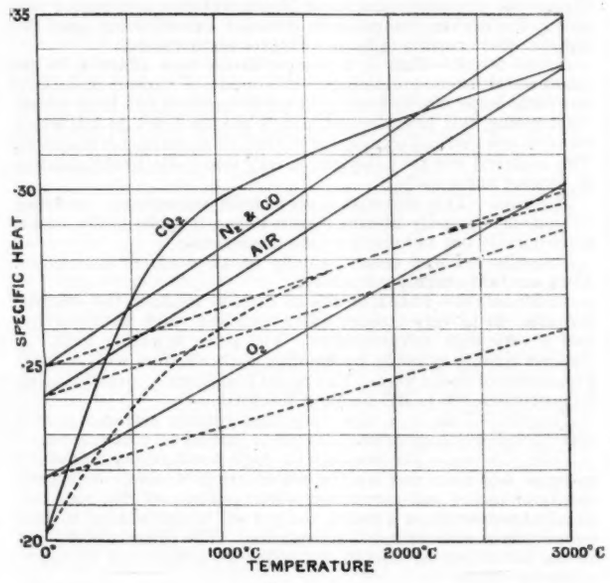


Fig. 3.

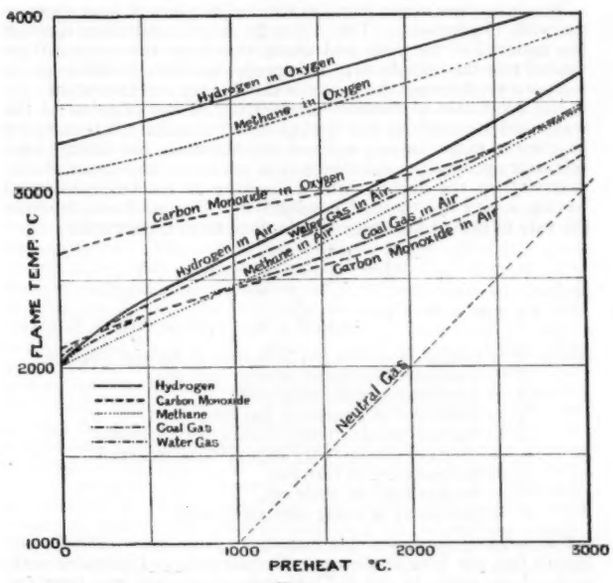


Fig. 4.

of preheat and the resulting flame temperature for a number of fuels. It should be noticed how the effect of increasing dissociation and specific heat of products reduces the temperature rise as the initial temperature increases; this being most marked in the case of the gases containing the largest proportion of carbon to hydrogen.

It must be pointed out that the diagram should not be interpreted too literally, as it is impossible to carry preheats to the temperatures shown in the case of gases which, like methane, decompose at temperatures above 800° C.; while, owing to endothermic reactions which occur while heating some producer gases, the effect would be secured at a slightly lower temperature than that shown on the diagram. The calculation of such effects is, however, an unnecessary refinement for our present purpose. It may be asked, What is the use of contemplating gas temperatures so much higher than that of any commercial furnaces? The reply is that the rate of transfer of heat from the gas to the work to be heated is proportional, other things being equal, to the difference in temperature, and that therefore the speed of operation, and consequently the output of work, can be increased by increasing the gas temperature.

### Rate of Heat Transfer.

A gas can exchange heat with a solid surface at a different temperature in two ways: (1) By radiation from the surface; and (2) by actual contact of the gas molecules with the surface. As most of the gases met with in furnace practice are practically transparent to radiant heat, and can themselves only radiate slowly, this method is relatively unimportant for our purpose; and we are driven to consider the other. By making two assumptions which are substantiated by giving results agreeing with experiments—viz., that the heating is effected by individual molecules of the gas striking the solid surface and being brought to rest there, and then rebounding therefrom, heated or cooled to the same temperature as the surface, in a direction which, on the average, is perpendicular to the surface; and that the frictional resistance to the flow of the gas is occasioned by the energy destroyed by the bringing of these molecules to rest, and by giving them the velocity of the gas stream after rebound—we arrive at a formula from which the rate of heat transfer can be calculated, if the temperature of the gas and surface, the resistance to flow, and the specific heat of the gas, are known. It is—

$$H = 2k \frac{Q}{x^2} (\theta - t) \ (Cv)_t^{\theta}$$

where H = rate of heat transfer from gas to surface per unit area per second
$Q$ = quantity of gas flowing per second
$k$ = so-called co-efficient of friction of flow
$\theta$ = temperature of surface
$t$ = temperature of gas
$(Cv)_t^{\theta}$ = mean specific heat at constant volume between $\theta$ and t
$x$ = mean depth of gas stream over surface.

This means that in any particular case the rate at which heat can be transferred from a gas to a solid is proportional, first, to the difference in temperature between the gas and the solid, and secondly, to the turbulence of the flow—*i.e.*, the back-pressure of the furnace—and that the rate of heating can be increased by increasing these factors. I have not yet been able to get actual figures and tests which would allow of designs being prepared using this information quantitatively; but the subject is one of interest to all furnace designers.

From what has already been said, it will be seen that the possibility of increasing the temperature difference is limited to some extent by the physical properties of the furnace gases. But when it is remembered that at present the back-pressure offered by furnaces is generally measured in fractions of a tenth of an inch

TABLE IV.—*Properties of Refractory Materials.*

| Substance. | Refractory Test. | Working Temperature. | Mechanical Strength. Tons/Sq. in. | Weight per C.Ft. | Specific Gravity. | Specific Heat. | Thermal Conductivity. C.G.S. | Approximate Cost. | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Per Lb. | Per C.Ft. |
| | °C. | °C. | | | | | | d. | s. d |
| Firebrick | 1630 | 1300 | 0·5 | 137 | 2·20 | 0·20 | 0·002 | 0·175 | 2 0 |
| Porous brick | 1500 | 1000 | 0·04 | 31·5 | 0·5 | 0·20 | 0·0004 | 1·91 | 6 0 |
| Silica brick | 1710 | 1400 | 0·35 | 109 | 1·75 | 0 191 | 0·003 | 0·275 | 2 6 |
| Magnesia brick | 1800 | 1600 | 2·0 | 150 | 2·40 | 0·220 | 0·017 | 1·12 | 14 0 |
| Chromite brick | 1800 | 1600 | 1·75 | .. | .. | 0·174 | 0·006 | .. | .. |
| Bauxite brick | 1900 | 1700 | .. | .. | .. | .. | .. | .. | .. |
| Carborundum | 2200 | 2000 | 6·5 | 158 | 2·53 | 0 18 | 0·0243 | 18 | 237 0 |
| ,, bonded | 2000 | 1800 | 5·6 | 150 | 2·40 | 0·162 | 0·0275 | 12 | 150 0 |
| Alundum | 2000 | 1800 | .. | .. | .. | .. | 0·004 | .. | .. |
| Zirconia | 2600 | 2300 | .. | .. | .. | .. | .. | 48 | .. |
| NiCr alloy | 1400 | 1000 | 12 | 515 | 8·3 | 0·11 | 0·10 | 66 | .. |
| Stainless steel | .. | 830 | 40 | 490 | 7·85 | 0·11 | 0·10 | 33 | .. |

of water, it will be realized that there are possibilities in the increase of the velocity of the gases in furnaces. The same remark applies to the transfer of heat in preheating arrangements, in which any increase of duty which will allow of the cutting down of dimensions will reduce the loss of heat through the containing walls, &c. If one examines some designs of recuperator, one is struck with the idea that the intention was to cool the waste gases, and let the incoming air take care of itself.

### HEAT LOSSES THROUGH WALLS.

We now come to the consideration of the loss of heat through the walls of a furnace. This is lost by actual conduction through the material of the walls and dissipation from the outer surface thereof into the outside air. It is proportional to the difference in temperature between the inside of the furnace and the outside air, to the coefficient of thermal conductivity of the material of the walls and inversely to the thickness of the walls. It is common practice to make furnace walls of two materials, one having high refractory properties, and therefore a somewhat high thermal conductivity on the inside, with a backing of insulating material having a very low thermal conductivity. For such construction the rate of loss of heat may be obtained from the formula—

$$H = \frac{e\left(\frac{R+X+Y}{R}\right)^2(\theta_1-\theta_2)}{1+e\,(R+X+Y)^2\left\{\frac{X}{k_1R(R+X)}+\frac{Y}{k_2(R+X)(R+X+Y)}\right\}}$$

where H = rate of heat loss per unit area of interior surface,
R = equivalent radius of interior surface,
X = thickness of refractory wall,
Y = thickness of insulating backing,
$k_1$ = thermal conductivity of refractory material,
$k_2$ = thermal conductivity of insulating material,
$\theta_1$ = temperature of furnace,
$\theta_2$ = temperature of outer air,
$e$ = emissivity of outer surface of wall.

For ordinary furnaces, this loss varies from 4000 B.Th.U. per square foot per hour in the case of small unlagged furnaces with walls 4½ in. thick, to 400 B.Th.U. per square foot per hour for lagged furnaces with walls 14 in. thick, per 1000° C. (1800° Fahr.) of working temperature.

As the heat lost through the walls is taken chiefly from the high-temperature zones of the furnace, it can only be supplied by the furnace gases at a relatively low efficiency; and it is therefore important to reduce the loss to the lowest possible amount, and also to ensure that the actual combustion zone is protected in such a way that as little heat as possible is directly conducted therefrom in this manner. The above formula indicates what steps can be taken to reduce the losses. They are:

1.—Reduction in the area of conducting surface. This can be done by the choice of simple shapes, and reducing the volume of the furnace to the lowest necessary for the work. Much can be done in this direction by increasing the rate of transfer of heat by means which have already been considered.

2.—Selection of material of low thermal conductivity.

3.—Increase the thickness of wall. The effect of this is more marked with large than with small furnaces.

The furnace designer has to select his materials to meet a number of mutually contradictory requirements; and it is therefore necessary to study the physical properties of the materials available. The points to be watched are, of course—first refractoriness or ability to work at high temperatures; mechanical strength to withstand at the temperature attained the stresses imposed by the design; thermal conductivity, which for some purposes should be as low and for others as high as possible; and last, but not least, cost.

### PROPERTIES OF FURNACE MATERIALS.

Table IV. gives the principal properties of the furnace materials now in use. It will be seen that, as the refractory test required goes up, the price increases very rapidly; and it is only for purposes where the ordinary silica or fireclay bricks are unsuitable, that the use of the more expensive materials can be justified. A short description of these refractories is given.

*Fireclay and Silica.*—This material is much the cheapest refractory, and consists of aluminum silicates in various proportions, from a pure clay containing about 40 p.ct. of alumina, through the ordinary fireclays containing about 30 p.ct. of alumina to silica brick containing 96 p.ct. of silica. Its refractory properties are much affected by impurities; and a good brick should not contain more than about 2 p.ct. of iron oxide and 1 p.ct. of alkali salts. The bricks are acid in character, and are therefore rapidly attacked by basic slags; and this point should be watched in designing furnaces, where they are formed. In favourable circumstances, these bricks will give satisfactory service if the working temperature does not exceed about 1400° C.; but the life is rapidly reduced at higher temperatures.

*Porous Brick.*—This is a comparatively new addition to the commercial furnace materials. It is made of various materials; one form being chiefly fireclay to which sawdust has been added. On burning, this is consumed, and a porous brick is left which owes its low thermal conductivity to the air contained in the pores. The material will probably prove very useful for heat insulation in furnace outer walls.

*Magnesia.*—This material is very highly refractory. On being subjected to rapidly altering temperatures, it spalls badly, and is consequently not suitable for such conditions.

*Chromites.*—These consist chiefly of an oxide of chromium. They are fairly highly refractory.

*Carborundum.*—This is a silicon carbide made in the electric furnace. It is very strong, has a relatively high conductivity, and a very high refractoriness. The price is rather high. A cheaper quality is made by bonding carborundum with a small proportion of china clay. The result is inferior in practically all its properties, but is still highly refractory.

*Zirconia.*—This is a new very high quality refractory, at a correspondingly high price. Its use is limited on this account.

*Nickel Chrome.*—The demand for high conductivity refractory material has been met by the introduction of alloys consisting chiefly of nickel and chromium, which possess all the good mechanical properties of a metal, and yet will stand heating to high temperatures without sensible oxidation. The price is high; but as the metal can be cast in thin tubes, its weight can be made relatively small.

*Stainless Steel.*—So-called stainless steel will withstand a temperature of over 800° C. without scaling; and this material will probably be much used in future for small furnace parts.

We are also promised a method of treating iron tubes with powdered aluminium, so as to render them resistant to heat; but very little information is yet available as to this process.

### THERMAL EFFICIENCIES.

Returning for a moment to Table I., let us glance again at the thermal efficiencies already obtained. It will be seen that considerable progress has been made; and I venture to predict that before long it will be possible to attain efficiencies of 50 p.ct., at the temperatures commonly required—viz., under 1400° C.

In calculating the figures in Table V., I have allowed for an

TABLE V.—*Relative Costs of Fuels.*

| Fuel. | | Capacity of Installation. Therms per Hour. | Cost per Therm Supplied. | | | Assumed Efficiency at 1000°. | Cost per Therm Usefully Employed. |
|---|---|---|---|---|---|---|---|
| Kind. | Price. | | Fuel. | Labour. | Total. | | |
| | Per Therm. | | d. | d. | d. | Per Cent. | d. |
| Coal gas | 10·75d. | .. | 10·75 | .. | 10 75 | 25 | 43 |
| ,, | 8d. | .. | 8 | .. | 8 | 25 | 32 |
| Blue water gas | 6d. | 60 | 6 | .. | 6 | 25 | 24 |
| | Coal per ton. | | | | | | |
| Producer gas | 50s. | 50 | 5 | 1·6 | 6 6 | 20 | 33 |
| Self-contained producer | ,, | 300 | 4 | 1·6 | 5·6 | 25 | 22·4 |
| ,, ,, | ,, | 5 | 4 | 2·5 | 6·5 | 25 | 26 |
| Direct fire | ,, | 5 | 2 33 | 2·0 | 4·33 | 8 | 54·1 |
| | Per gallon. | | | | | | |
| Crude oil | 1s. | .. | 6·85 | .. | 6·85 | 25 | 27·4 |
| Coal-tar oil | 1s. 2d. | .. | 8·9 | .. | 8·9 | 25 | 35·6 |
| Refined oil | 2s. | .. | 15 | .. | 15 | 25 | 60 |
| | Per unit. | | | | | | |
| Electricity | 1d. | .. | 29·2 | .. | 29·2 | 60 | 48·6 |

efficiency of only 25 p.ct. in endeavouring to show the position of coal gas as an industrial fuel. The question of the figure to be ultimately attained will not affect the relative position much, except possibly to accentuate the inferiority of solid fuel used in direct fires, as increases in the duty obtained from one type of furnace will be followed by corresponding increases in the others. In the costs given, no allowance is made for the advantages of coal gas given in the early part of the paper, as their monetary value must be assessed for each particular case.

The table appears to show that town gas will have a future before it for all operations on a scale below that which will allow of the economical use of producer gas; and that in many cases where the cleanliness, regularity, small space occupied, and high efficiency of coal gas apparatus is important, this will turn the scale even in large installations. I trust that in this matter the industry will see to it that the advantages of gas fuel will be kept under notice of possible consumers, and that all possible improvement in the apparatus available will be made. The industry will not then have to complain of the results.

In conclusion, I must apologize for the many interesting things which have been omitted. The relative advantages of recuperators and regenerators require to be carefully considered; and mention should be made of the special conditions which have to be met for some kinds of work. But these are subjects demanding a paper, if not a text-book, to themselves.

### DISCUSSION.

The PRESIDENT (Mr. Frank J. Pearse, of the North Middlesex Gas Company) said he felt they had just been listening to a very highly scientific discourse—a discourse which showed that the author was not only an expert in furnace work, but that he had devoted a remarkable amount of attention to it. In all probability some difficulty would be experienced in discussing the paper offhand, because almost until the end was reached the whole of the matter needed really careful study before one could attempt to express an opinion one way or the other; but he was sure that Mr. Booth would be only too pleased to answer any questions that might be put to him. The table showing the comparisons of efficiency between various types of furnaces, and the one setting forth the cost of different fuels, were highly instructive. The first demonstrated how much ground there was yet to cover in improving the gas-furnace; and the latter made it very clear to them that, even in its present state of efficiency, gas was very much to the fore as a fuel for furnace work. With a very little more efficiency in the furnace, gas would very easily be on top.

Mr. D. J. WINSLOW (Lea Bridge) agreed with the difficulty of following straight away so highly technical a lecture. In connection with the efficiency of furnaces, he would like to ask, in reference to the amount of heat usefully employed in the work, how this was arrived at. The author showed how he calculated the amount of heat lost in the flue gases. They were all interested in the efficiency of furnaces; but in the past the figure to which he referred had apparently sometimes been arrived at in a rather crude manner. He had been very much struck with the amount of heat which Mr. Booth said was actually lost by radiation through the walls of the furnace. Those of them who had seen the average type of furnace at work, in which the outer walls did not appear to be very hot, would have thought the loss would not have been nearly as much as from 40 to 45 p.ct. Were the results in this respect arrived at by calculation, or did he get his figures by any other means? It was interesting to note the remarks in the paper on the subject of turbulence in the flow of gas; and he had been wondering if it would be possible usefully to apply this idea to the matter of heating water in vessels on a gas-ring. The calorific value of coal gas (which the author explained was pre-war) was shown to be only 338. Surely this must be an error.

Mr. BOOTH pointed out that they were Centigrade units. Reckoned the other way, it came to over 600 B.Th.U.

Mr. WINSLOW said that, as to the competitors with coal gas for furnace heating, undoubtedly producer gas had to be considered. They were shown in the table the size of plant at which it became a serious competitor; but he could not quite follow this in detail. For instance, with a large works using a considerable amount of gas for furnace work, what was the critical point at which producer gas became a serious competitor with coal gas? Did the author get so good an efficiency from producer gas in furnace work as with ordinary town gas on the average?

Mr. BOOTH replied that, with regard to the question about the method of arriving at the figures of efficiency of the furnaces, there was no other way of ascertaining the amount of heat expended in useful work than by actual calculation; and the same remark applied to the heat lost through the walls of the furnace. The figures he had shown were not all his own. They had been taken from a large variety of sources, but might be regarded as fairly reliable. As to turbulence in the flow of gas, and utilizing this factor to increase the efficiency of water-heating operations, this was already being done in a good many installations. In boiler practice, with forced draughts, it was not uncommon to put special retarders in the tubes, in order to develop this turbulent flow. The success of Dr. Bone's system was dependent, not so much on surface combustion as on the turbulence which was secured. One obtained really tremendous rates of heat transfer by the Bone system, owing to the turbulence. This question of turbulence was a very real one. As to the size of an installation of producer gas in a works to compete with coal gas, it depended upon the works and a lot of other things. The figures he had given were for what he considered would be the smallest self-contained unit that it would pay to instal. If one was going to distribute heating gas, it was necessary to know all the conditions before deciding what was the best thing to do. As to whether one could get the same efficiency from a producer-gas furnace as from a coal-gas furnace, it would be seen that the figures he had allowed in his table were 20 p.ct. for the former as against 25 p.ct. for coal gas.

Mr. J. HEWETT (South Metropolitan Gas Company) referring to the last table said the author had shown in this that producer gas was cheaper per therm than coal gas. He had been wondering in his own mind whether the cost of the installation of the producer-gas plant and the necessary outlay on upkeep had entered into the calculation. It must be remembered that coal gas was generally supplied straight to a job, merely by turning on a tap or some similar operation; whereas for the supply of producer gas it was necessary to erect a plant, and to have someone to look after it. Had all this been taken into account?

Mr. BOOTH said he had included the running costs only, and had not taken into account capital costs, which varied to such an extent that it was difficult to arrive at figures. He had included an estimate for labour on the plant, and for the labour and materials necessary for maintenance.

The PRESIDENT, in closing the discussion, said they were much indebted to the author, who was always most willing to come forward and help the Association in any possible way.

A hearty vote of thanks to Mr. Booth was passed, on the proposition of Mr. F. E. WOODFINE (South Suburban Gas Company), seconded by Mr. H. W. KERRIDGE (Croydon).

## GAS FOR ENAMELLING WORK.

Though often spoken of as enamelling, japanning should not be confused with vitreous enamelling, says Mr. J. H. Gumz, industrial gas engineer to the Public Service Company of Illinois, in an article appearing in the "Gas Record." With japanning, the baking is done at temperatures that range up to 400° Fahr.; whereas enamelling, in the true sense of the word, consists of coating metal, usually steel, wrought iron, or cast iron, with a finely-ground composition of glass and various other materials, and fusing it at temperatures from 1200° to 2000° Fahr., depending upon whether the material to be enamelled is cast or wrought iron or steel. The higher temperatures are practicable only in the direct-fired gas-furnace. The enamel maker carefully weighs-out the different materials to go into a batch; and, after mixing, the batch is melted in a smelter at about 2200° Fahr. for from two to four hours. The melting of enamels should be done with gas, as the use of coal, coke, or oil requires a large excess of air; which oxidizes some of the ingredients, and has a tendency to contaminate the enamel by depositing dust, ash, or carbon on the melting batch. The cost of smelting with gas is about the same as with other fuels; but the advantages of gas make it preferable. Each piece to be treated receives three or more coats of enamel. The first, or ground, coat is burned on at a temperature of from 1750° to 1800° Fahr. for steel; the second, from 1650° to 1750°; and the third (or finishing) coat, at 1600° to 1700° Fahr. The length of time the ware is burned depends on the coat, and also on the weight of the metal being enamelled. This process has almost invariably been done in muffle-furnaces, to escape damage by products of combustion. The author, however, describes and illustrates a gas-fired furnace using neither muffle nor semi-muffle, but instead the surface combustion method of firing by radiant heat. This furnace was developed by his Company, in conjunction with the Surface Combustion Company of New York. It has proved very successful, both as regards quality and quantity of work turned out, and also from the operating cost standpoint. Among the many advantages of the direct-fired gas-furnace, it is much smaller for the same sized working space than any other type of furnace. The furnace is fired by a series of high-pressure inspirators and burners, operating at 5 lbs. On figures quoted in the article, the surface combustion type gas-furnace shows a considerable saving over the coal-fired muffle type. In fact, the gas-furnace usually pays for itself in less than a year. Extra savings can be made in gas-fired furnaces by using the flue gases in waste-heat boilers and drying rooms. When used to generate steam, there is still considerable heat in the flue gas after leaving the boiler; and a fan can be used to blow it on the ware that is being dried.

### Savings with a Portable Bucket Loader.

From figures which have been quoted in the "Gas Record," it appears that, through the purchase of a self-feeding bucket-loader, the Detroit City Gas Company have made a saving of $60 a day in the handling of oxide, coal, coke, and other bulk materials. Formerly a gang of fifteen men was required in the yard of one of the Company's plants to handle these materials; but the bucket-loader and three men have replaced this gang. The loader is frequently used for turning the oxide after it has been discharged from the purifiers for revivification. At times the oxide is loaded into wagons; and in this work, the machine has maintained an average load of 1½ yards in two minutes, with a maximum load of 1½ yards in 1 min. 5 sec. Naturally, the saving in cost varies somewhat with the character of the work done. While building construction was being carried on, it was found that a loader and three men could do work which formerly required more than fifteen men to perform as quickly. Sometimes, too, the force at work with the loader could be reduced to only one operator and one labourer, which, of course, would increase the comparative saving secured. According to figures furnished by the Detroit City Gas Company, the greatest amount that has been saved in one day up to the present time has been $84.

## MIDLAND JUNIOR GAS ASSOCIATION.

A well-attended meeting of the Midland Junior Gas Association was held in the Reading Room of the Gas Department, Council House, Birmingham, on Thursday last—Mr. W. J. PICKERING in the chair.

Mr. L. H. THOMAS, Assoc.M.Inst.Mech.E., of the Nechells gas-works, Birmingham, read a paper [of which the following are the main portions] entitled

### THE APPLICATION OF REINFORCED CONCRETE TO GENERAL GAS-WORKS PRACTICE.

It is not intended in this paper to describe or discuss at any length the principles of reinforced concrete design. Its main object is to discuss some of the advantages and disadvantages of its use in gas-works, and to refer to some of the plants already executed in this material.

Concrete will withstand a considerable compressive stress, but has practically no resistance to tension; while steel is strong in tension. These diverse properties are used by embedding steel in concrete in such proportions that the steel is subjected to tensile stress in resisting tension and shear, while the concrete itself is subjected to compressive stress only.

Like every other constructional material, reinforced concrete has striking characteristics which, when properly used in advantageous circumstances, make it the best and most economical material that could be employed. It is very durable. Instances of the pitting of the steel due to electrolysis have been known; but with proper precautions there is no risk of this taking place. The protection of the embedded steel is dependent upon the concrete being solid and non-porous, so that much depends on the mixing of the concrete. The proportions of the components should be properly ascertained by careful experimental measuring, and once decided upon should be rigidly adhered to.

Another item which is usually overlooked is that of the proportion of water used in the mixing. If the mixture is too dry, it is difficult to get it down into the forms and round the reinforcement; but if it is too wet, the strength of the concrete is reduced considerably. On this account some engineers are now specifying the amount of water which must be used. The mixture must be continually rammed into the shuttering and round the reinforcement, to eliminate voids. For tanks and walls which have to resist liquid pressure, the absence of voids is essential; but with properly gauged and mixed work, there is little danger. There are now on the market a number of preparations—usually a very finely ground insoluble material such as china clay—which, when mixed with the other components in the dry state, make the absence of voids almost a certainty. The correct ramming and mixing of the concrete also has a great effect on another important point—the so-called adhesion between the steel and the concrete. When good concrete is properly rammed round the reinforcing bars, the adhesion between the two is at least 100 lbs. per sq. in. of surface; and this is sufficient for all but very short bars to prevent the steel slipping. There is no need to have specially rolled and corrugated bars as reinforcement on this account; and if the ends of the bars are turned-up, as is usual, the structure will be quite as strong in this direction as in any other.

Reinforced concrete is to a large extent fire-resisting and shock-resisting. The resistance to vibration and shock is mainly due to the monolithic character of the complete structure. If the structure demands the highest fire-resisting qualities, special aggregates should be used. No limestone should be included, but blast-furnace slag or well-burnt clinker should be employed as aggregate, though the inclusion of the latter rather weakens the resulting concrete.

It is difficult in these days of continually changing prices to discuss costs; but Mr. A. E. Broadberry, of Tottenham, has stated that, with the prices ruling at the time of the erection of the reinforced concrete purifiers there, cast-iron boxes on steel stanchions and girders would have cost just about twice as much. A French gas engineer made during the war some reinforced concrete hydraulic mains for his retort-house, because of the difficulty of obtaining cast-iron mains; and he found that the price was about two-fifths of what cast-iron mains would have cost.

Another great advantage of its use in gas and chemical works is its resistance to corrosive atmosphere and to fumes. There are many applications in gas-works where, even if the cost of construction was considerably greater than that of steel or cast iron, the abolition of maintenance and repair would justify its adoption. For purifier sheds and boxes—especially cyanide purifiers, where painting and repair costs and also depreciation are very great—reinforced concrete should always be used. There are still many gas engineers who would not care to risk passing their gas through boxes constructed of reinforced concrete, in spite of the success of those already erected in this country and in America; but the substructure, revivifying floors, and supports to the roof should most certainly be composed of this material. In the various bye-products plants of gas-works there is ample scope for its use; and it should be employed in preference to steel or corrugated iron if there are likely to be any corrosive fumes about.

One of the greatest disadvantages to reinforced concrete work as applied to gas-works has been the time taken to erect a structure. This, however, is not strictly inherent in the material, but has been mainly due to the small number of contractors who have specialized in this work, and to the fact that usually local builders will execute the work at a lower cost than specialists. Of course, structures erected in gas-works are usually small, and would not warrant the use of large plant; but when properly organized with plenty of moulds and shuttering, reinforced concrete work can be carried out expeditiously. One matter which has made reinforced concrete work slow of execution is the shuttering or forms which are necessary to support the wet concrete until it has hardened sufficiently to be self-supporting. A great stock of suitable timber is necessary for the erection of a large structure, unless the work is carried out in small sections, and the timber from one part re-erected as shuttering for the next section. The latter, of course, makes the progress of the work very slow; and unless the sections are exactly alike—a condition not often met with in practice—a good deal of timber is wasted at each removal, and a skilled carpenter is needed to alter and re-erect the forms.

The shuttering is also one of the chief items in the cost of this work; for it is estimated that at present 33 to 45 p.ct. of the cost of erecting a structure in reinforced concrete is absorbed in the cost of timber and the labour of erecting and dismantling it. Probably 25 p.ct. of this timber is useless for further work, and considerable expense is entailed to re-erect the remainder. In consequence of this, many firms have set themselves the task of designing suitable shuttering in steel, which can be used many times without undue depreciation; and there are now on the market several makes of steel shuttering. With these forms, which can very easily be fixed and removed, walling can be erected at a considerably reduced cost and more expeditiously than with timber forms. Realizing the great advantage of the work of the Engineering Standards Committee, there has also been much thought given to the question of standardizing beams and columns, so that metal forms could be made from them and used on all kinds of structure; but this has not yet arrived at a practical stage.

Again, the greater length of time is often more apparent than real, because with structures of steel and cast iron the greater part of the work is carried out in the contractors' shops, and only the actual erection on the site; while in reinforced concrete the whole of the work is done on the site. The time taken in erecting and dismantling in the contractors' yard is entirely done away with; and though the contractors may be on the site a great deal longer, the actual time for completion from the date of ordering should be considerably less. Several attempts have been made to reduce the time by the use of pre-cast columns, beams, &c.

There is great danger in placing contracts with firms who are not specialists in this class of work. The strength of a reinforced structure depends on many apparently trivial details being correctly carried out. The necessary calculations for reinforced concrete work are large; and when a designer has calculated on certain positions for his steel and a definite strength for his concrete, great care must be taken to ensure that these are correctly existing in the structure. It is imperative that the work should be put in the hands of qualified and experienced men only, even if it entails a slightly higher expenditure; for careless work is not so apparent and yet more dangerous in reinforced concrete work than in any other form of structural engineering.

Reinforced concrete piles are now largely used for all kinds of foundations; but there is no need to describe these, since most of you heard or have read the admirable Presidential Address by Mr. T. H. Poulson, of Stafford, before this Association in 1918, and will remember the commendation he gave them in his concluding remarks. While on the subject of foundations, piling (which is always expensive) can sometimes be avoided by the laying of a reinforced concrete raft. If the ground is not too bad, the weight of the heavier parts of a building or structure may be distributed by this means over a sufficiently big area to reduce the weight per unit area to that of the safe bearing pressure of the ground; and a considerable saving may be effected in this way.

Reinforced concrete has been largely used throughout the world for bunkers for coal and coke. It has been employed in collieries for overhead bunkers up to 2000 tons capacity, and is quite satisfactory for this work. It is cheap in first cost, and the outlay on maintenance is negligible; while with steel bunkers—especially in gas-works—the cost of painting, and after a time patching, is considerable. Since concrete is harder than coal, there is no abrasion of the walls by the sliding material. Probably the majority of the large gas-works in Great Britain have some reinforced concrete coal and coke hoppers at the present time.

One of the most economical uses to which reinforced concrete can be put is that of retaining walls for earth, coal and coke, or similar material. The reason for this is that in a brick, masonry, or concrete retaining wall the weight of the wall itself must be sufficient to resist the thrust of the retained material; and no tensile stress can be allowed in the wall. With a reinforced concrete wall, however, a shelf or slab is cast horizontally, usually at the base only, but in some cases about half-way up also, so that the weight of the retained material acts as a balance-weight resisting the overturning of the wall. Since tension is taken by the steel reinforcement, the wall itself need only be a few inches thick, being connected to a broad base, and having buttresses or counterforts also tied into the base. In a typical case, for instance, the concrete per foot run for a reinforced concrete wall would be about 16 c.ft., and for a mass concrete wall of about the same stability some 86 c.ft. From this it will be seen that there is a great saving in the amount of concrete used, which will

much more than pay for the steel employed and extra shuttering required. Reinforced concrete retaining walls have been much used for coal and coke stores, and as earth retaining walls.

Another use of a similar nature to which reinforced concrete has been applied is that of storage tanks for tar, liquor, oil, water, &c. The extensive and continued use of reinforced concrete for oil-storage tanks in America (where it has been employed for tanks up to 43,000,000 gallons capacity) shows conclusively that, when properly made, they are quite tight. A little while ago, a number of tests were carried out in America to ascertain the tightness of tanks when treated in various ways. Several kinds of commercial liquids, oils, and chemical solutions were used, and the penetrations recorded. It was found that for most liquids a good, plain, dense, 1:2:4 concrete was more efficient than any treatment of a slightly poorer concrete.

For oil storage, reinforced concrete tanks have several advantages over steel tanks. They can be built below ground, thus reducing the risk of fire; and the evaporation from them (often a costly item with steel tanks), on account of big differences in temperature, is considerably reduced, even when built above ground. The cost of caulking and painting is entirely eliminated. The first cost relative to that of a steel tank will, of course, vary with local conditions; but generally there will be very little difference between the two.

Not only is this method of construction used for underground and ground-level tanks and reservoirs, but for overhead tanks. A large works often has difficulty with its water supply; and an overhead storage tank, at a sufficient height to supply water at the required pressure, is used to ensure a continual, steady supply. Unless there are high buildings or structures which can be used to support such a tank, the cheapest and most durable tank is made of reinforced concrete, supported on reinforced concrete columns. There are many of these about the country; and the low maintenance, low first cost, and durability make them almost ideal. The most suitable covering material for tanks containing ammoniacal liquor and light oils which easily evaporate is reinforced concrete; and it has been extensively employed for covering brick tanks and reservoirs.

Gasholder tanks have also been constructed of reinforced concrete; but I am not sure if there are any in this country. It seems strange, in comparison with the heavy masonry and brick tanks usually used, to construct a tank with comparatively thin walls of reinforced concrete (one in Melbourne 83 ft. in diameter has walls 6 in. thick at the top); yet the strength is the same and the resistance to shock much greater. Also the monolithic structure ensures against the local failing of a tank wall, which has been known to happen in brick tanks; and reinforced concrete columns are so much stronger than brick piers that the foundations for the guide-framing (where this is used) would be much cheaper in the former than in the latter. Certainly, the covering for the dumpling would be the stronger if reinforced; and the shallower layer of concrete necessary would almost pay for the reinforcement. When a crown support or umbrella is used, this would be cheaper and more lasting in reinforced concrete than in steel, which is sometimes used, and would at the present time, when timber is so costly, probably be cheaper than timber joists on cast-iron columns.

For small tanks, where the thickness of the wall need not be more than 4 in., a very economical method of construction is to use metal lathing, and plaster both sides with cement mortar. These tanks can be made quite watertight by mixing one of the finely powdered preparations, already referred to, with the outside coat; and they are quite durable. Their great advantage is that no shuttering or forms are required; and though the mortar is more costly than concrete, and the method of applying it also more costly, yet the reduction due to the absence of shuttering is usually more than these extra costs.

Buildings of all kinds have been constructed in reinforced concrete; and in places where plenty of daylight is necessary, they stand alone. A reinforced concrete frame filled-in with brickwork or panels of metal lathing and plaster, for 2 ft. to 3 ft. above the floor, and large steel window-frames from the panels to the ceiling, makes the best daylight shop yet achieved. For floors it is very useful—more especially for floors above ground. Where machinery is used on first or higher floors, it makes the most suitable structure known, as resistance to vibration and shock is so great. Generally the surface of a plain concrete floor is not hard enough for rough usage, as it crumbles and dusts; but this is due to the presence of too much water in the mixture. The screeding and spading of the surface causes most of the water to come to the top; and consequently the surface is very porous when the water has dried-out. But there are several preparations on the market for hardening the concrete; and with one of these a very hard, dustless floor can easily be obtained.

While on the question of floors, there is another use of a similar nature to which it has recently been put—that is, for main roads. In all large gas-works it is important there should be a good main carting road; and at their Hilsea works, where the Portsea Island Gas Light Company have to maintain an approach road, reinforced concrete was tried some eighteen months ago. Part of the road was laid in this way; the other part in the usual macadam. The reinforced concrete portion was laid with 4 in. of concrete with reinforcement in the middle, and then 2 in. of hard concrete was laid on the top. At the time Mr. S. E. Whitehead wrote an article a few months ago, it was early to form a just comparison of the two parts laid; but the reinforced concrete part was then wearing perfectly. To lay a good road in granite sets or rags—a usual type on gas-works—it is necessary to put 4 in. or 6 in. of concrete under, and then there is the cost of the sets and binding materials; so that a reinforced concrete road should come out cheaper, and be more satisfactory than a paved road. It is important that no mains or pipes should be laid under a reinforced concrete road, except in a subway, as the monolithic nature—its great feature—is destroyed if part of the road is broken-up, and the reinforcement cut away.

Reverting to buildings, a number of houses for bye-product plant have been built in this country with a steel framing and metal lathing; the whole being covered with cement mortar. This construction makes a permanent building which will withstand corrosive fumes and is fairly cheap. The cost would be more than a steel-framed building covered with corrugated sheeting; but since the depreciation is very much less, and the building is more permanent, the higher first cost is outweighed by lower upkeep charges. This type of building has the advantage over an ordinary reinforced concrete building of having a better finish. Instead of form marks showing all over the surface, as in the case of walling shuttered with timber, the surface is smooth and pleasing.

### Reinforced Concrete Mains.

There is another use for reinforced concrete which certainly has a great future, and that is for mains. About four years ago, the Barnsley Smokeless Fuel Company used pre-cast gas-mains of 14-in. and 24-in. diameter. The mains were cast in 6-ft. lengths in steel moulds, the 24-in. diameter ones being 2 in. thick, and the 14 in. ones 1¾-in. thick. The mains were made by women at the works; and the cost was very much less than that of cast-iron mains. The joints were made with tarred tow between the pipes; and a cement collar was formed round the joints. These have been quite satisfactory. But the best reinforced concrete pipe made in the world is the Hume pipe, the manufacturing rights for which, in this country, the Stanton Coal and Iron Company have recently acquired. This pipe is made centrifugally; and the resulting concrete is very dense and hard. A cylinder of strong steel wire latticing of the correct size is placed in a steel cylinder, which is rotated. A carefully gauged and measured batch of concrete is next put into the cylinder, and the rotation continued for four or five minutes. The machine is then stopped, and any excess water which works to the inside is run off. The machine is then again rotated for a few minutes, to dry and harden the inside of the pipe. The pipe is then removed from the cylinder and stacked away to complete setting. The Hume pipe has been used in Australia and South Africa for some years, and has fulfilled the most sanguine hopes of its inventors. Pipes can be made to withstand 400 lbs. per sq. in. pressure without percolation. As a test, a mixture of petrol and paraffin was run into a pipe with blanked ends, and put under a pressure of 200 lbs. per sq. in.; and at the end of three months there was no sign of percolation. For such uses as gas-mains under ground, where the pressure is external, the pipes are made somewhat thinner; and since concrete is strong in compression, they easily withstand the pressure of the earth. Also, resistance to vibration is useful where there is traffic over the mains.

Joints are made by means of a collar 6 in. wide formed in the same way as the pipes, which is jointed by means of cement grout or run with lead and set-up in a similar manner to joints for cast-iron pipes. The ends of the pipes have a V-groove left in, so that when the pipes are brought together a diamond-shaped ring is left; and this is filled with a plastic jointing material, so as to ensure a tight joint. It is worthy of note that there has been no case of joints failing in any pipe-lines tested in the Colonies.

It is estimated that in this country these pipes will be cheaper than cast-iron or steel pipes. They can be made in 12 ft. lengths, and are much lighter than cast-iron pipes. Specials cannot be made centrifugally; and it is the centrifugal action which makes the pipes so dense. So that specials are made in cast iron with all spigot ends, and jointed with the reinforced concrete collar.

There are many other uses to which reinforced concrete has been successfully applied; but it would take too long to describe them. A few are canal basins, crane gantries, bridges, decking, subways, culverts, and chimneys. As in all cases of engineering design, there are limits to the economical use of reinforced concrete. It should not be used for long girders; but for big spans reinforced concrete arch ribs are very economical. Frames with a large proportion of tension members are not economical in reinforced concrete, though roof trusses are often made this way, and are successful and lasting, but look somewhat heavy, and are not pleasing to the eye.

There is certainly a great future before this method of construction; and it is well suited for use in gas-works when the work is carefully carried out.

### DISCUSSION.

The President, in proposing a vote of thanks to Mr. Thomas, commented upon the interesting and comprehensive character of the paper, and said it would appear that the claims of concrete for many classes of work in gas engineering, having regard to the low cost of maintenance, were worthy of careful consideration.

Mr. C. F. W. Rendle (Redditch) seconded the resolution. He supposed, he said, that no one in these days had any deep-rooted objection to the use of reinforced concrete; and after Mr. Thomas's admirable paper, he thought many would be stronger adherents to the application of the material in gas-works practice. It was apparent that for many purposes reinforced concrete could be economically

dealt with. Evidently corrosion of steel was almost unknown with good concrete—that is if it were dense and free from porosity. The latter must, however, be guarded against by the use of too much water. He asked if rust should be removed from steel before it was used in the concrete; and would clinker, which might be used as a component part, have any prejudicial effect, seeing that it might have an acid content? At the works at which he was engaged, there was a gas-tank in the construction of which the principle of reinforced concrete was embodied; and the tank was perfectly satisfactory. It was most interesting to know that reinforced concrete could be made impervious to oil, &c. What, he asked, was the behaviour of reinforced concrete under great vibration? He imagined that the joints would be the first to give. He would also like to know how costs compared with mains of metal—cast iron or steel.

Mr. W. MACNAUGHTON (Wolverhampton) said, as to the mixing of the materials, no hand mixing could compare with machine mixing. It was also important that the concrete should be perfectly clean before a further layer was added—especially when work on a job was resumed after an interval, and other operations by workmen had been carried out.

Mr. W. B. COBB (Birmingham) commented upon the great advantage to be derived from the use of reinforced concrete in tank construction, in the saving of space. A 5-in. concrete wall was often adequate for the same purpose that a 24-in. wall was required in brick. The bridge crossing the Mersey at Warrington was a splendid example of the possibilities of reinforced concrete.

Mr. E. BRANSON (Birmingham) said too much importance could not be attached to the question of the mixing and gauging of the material. There should be adequate screening, and freedom from dirt. It seemed to him that a difficulty in the use of the material would be along mains in which it would be necessary frequently to put in new connections.

Mr. F. S. TOWNEND (Fuel Department, University of Leeds) asked for further information as to the different kinds of aggregate employed. He took it that, where high stresses were wanted, a limitation must be placed on the size of the granite chippings. The question of possible percolation was important because gas, under high pressure, would percolate where liquids would not. One of the latest forms of construction of a retort-house was the steel-framed building with panels of brickwork. While he appreciated the difficulty of comparing costs in these days, he would like to know if any comparison could be made between the cost of the reinforced concrete building and the steel-frame building.

Mr. WRIGHT pointed out that temperature played an important part in mixing. In America, salt water was used in winter to prevent the too-rapid setting of the material.

Mr. A. ST. D. CORDER said there was no doubt that reinforced concrete would effectively withstand vibration; and he instanced the case of the "Pill Boxes" made by the Germans, which withstood enormous battering.

Mr. F. CAUDWELL (Shrewsbury) inquired if the author had had any experience as to the cost and use of concrete lamp-posts.

The resolution was unanimously adopted.

Mr. THOMAS, replying to the discussion, stated that loose rust on steel should be entirely removed with a wire-brush before the bars were placed in the concrete. A rough bar, or one slightly rusted, was better than a bright bar. There was a danger in badly mixed concrete, because if there were voids and the air could reach the steelwork, there was the possibility of the bars slowly rusting away. This was why he made a point of the fact that reliable contractors should be employed to carry out the work. It required, in a special degree, care for detail, because of this liability for voids and the need for the steel being placed in its correct position. It was necessary to be careful then to see that only men who specialized in the work should be allowed to carry out reinforced structures. A few cases had occurred where the use of clinker had been the cause of corroding the steel; but such corrosion was always limited. If used for aggregate, clinker should be carefully chosen. As to the tightness of tanks, the question of the proper mixing and placing of the concrete came in. An instance had been brought to his notice of bungalows with concrete walls several inches thick; and though nothing had been done to render them waterproof, they were found waterproof in fact. With proper care, damp-proof buildings with concrete walls 4 in. thick could be secured; but the fear was that many builders would not give the attention that was necessary. Really good concrete, well mixed and rammed, was waterproof and oilproof. Vibration did not affect the mains to any extent, and experience in the Colonies showed absence of leakage even in pipes. It was of the first importance that there should be absolute cleanliness before fresh concrete was laid. The only difficulty he had known with regard to reinforced concrete purifiers was a tendency to "weeping" at the point at which the concrete was last laid, and upon which fresh concrete was placed a day or more later. Moisture sometimes exuded on the surface; otherwise there had been no trouble. At Tottenham, the plan had been adopted of occasionally painting over the inside of the boxes with hot tar; and it would appear that this was providing the remedy. It was always recommended that the work, when operations ceased for the day, should be "roughed," so as to ensure an effective binding for the next lot of material. It had been suggested that work should be carried on continuously, by day and night shifts; but the effect of this would be to so materially increase the cost that it would probably effectively rule-out the question of reinforced concrete. As to the use of coke breeze, that would not give a waterproof concrete, though it might be suitable for fire resisting. Concrete was not suitable for use where there were a great many "specials;" but it was all right for long lengths of mains. Broken bricks were not suitable for aggregate; harder material should be used. Granite chippings not bigger than would pass through a ¾-in. mesh were advisable. The evidence available in connection with the Hume pipes was that they were suitable for conveying gas, and that there was no danger of the gas percolating through the mixture. Cases were known in which the outside coating gave way under intense heat. Flaking might occur in such circumstances if lime were used in the aggregate. The tests made, however, by the Fire Prevention Committee had proved satisfactory. It would appear that there was little or not much difference in the cost of the steel-framed building with brick panels and the building of reinforced concrete with metal lathing and plaster panels. It seemed a little extravagant to add cement to prevent voids; various preparations could be used for this purpose. The care taken should be to prevent excess of water or insufficiency of sand. Salt water for mixing should be avoided, if possible. It was preferable to stop work during frosty periods. He had not seen any figures with regard to the cost of concrete lamp-posts; but during the war period, when wood was dear, concrete fences were cheaper than timber posts.

## SCOTTISH JUNIOR GAS ASSOCIATION

### (WESTERN DISTRICT).

#### Visit to the Summerlee Iron Works.

A large number of members of the Western District of the Scottish Junior Gas Association visited on Saturday last the well-equipped works, situated at Coatbridge, of the Summerlee Iron Company, Ltd. Representatives of the firm, including the departmental heads, and Mr. D. M. Mowat, the General Manager, met the visitors and conducted them over the works, which immediately adjoin the railway. Special interest and information were derived from a thorough inspection of the bye-product plant which has been introduced in connection with the works.

In the course of the afternoon, the visitors were hospitably entertained by the Directors of the firm.

DESCRIPTION OF THE BYE-PRODUCTS PLANT.

*Furnaces.*—The plant has seven blast-furnaces, four of which are on blast, the remainder being under repair. Each furnace is approximately 70 ft. high, 16 ft. 6 in. at the widest diameter, and 8 ft. 6 in. in diameter at the well, which is 3 ft. deep.

*Blowing Engines.*—The blast for the furnaces is supplied by two turbo blowers, capable of blowing furnaces with blast up to 9 lbs. per square inch.

*Stoves.*—There are eight hot-blast stoves for heating the blast before it enters the furnaces. Four of these stoves are in use just now. They are of the Ford-Monour type. The gas from the recovery plant burns in a central chamber, and the hot gases pass through chequerwork and give up part of their heat to the brickwork. The gas is allowed to burn for three hours, when it is shut off and cold blast allowed to pass through the stove in the opposite direction. The blast takes-up heat from the hot brickwork, and so the temperature of the blast is raised considerably (approximately 1300° Fahr.). The blast is usually allowed to pass through the stove for three hours, and is then cut off. The temperature of the stove is again raised (burning gas in it again), and so on.

*Treatment of the Blast-Furnace Gases.*—The fuel used in Scotland is splint coal, yielding about 60 p.ct. of coke and 40 p.ct. volatile matter, all of which goes into the gases. They also contain about 1·4 p.ct. of N, something like 15 p.ct. of which passes off as ammonia. The apparatus installed is a Gillespie plant, of the cooler and washer type.

The gas from the furnaces is collected in a gas-main, after passing through dust-catchers to remove the heavy dust, and thence passes into the tar-washer. The latter (which is an important part of the plant) is a long iron box, divided into two by a horizontal floor; the space above this again being divided into two by a longitudinal vertical division—the gases being delivered on one side and escaping at the other. Beneath the horizontal division is arranged a series of traverse plates with finely serrated edges, which dip beneath the water in the lower part of the vessel. The chambers above the horizontal division communicate, by openings, with opposite sides of these traverse divisions.

The gas from the furnaces enters the left-hand upper chamber and passes through the opening into one of the lower divisions. This being of large area, the rate of flow slackens, and the gas bubbles-up slowly under the division plate, and is broken-up by the serrated edges of the plate into minute streams. It then passes up into the right division and away. The gas from the furnaces flows into the primary or tar washer, which it enters at about 350° Fahr., and, after being washed with tar, leaves at about 200°. The hot gases thus remove some of the water in the tar, and so help to concentrate the green tar. The gas next passes to the atmospheric condensers. These consist of 432 pipes, 2 ft. in diameter and 40 ft. high. They are arranged in 24 rows of eighteen pipes, each connected alternately at the top by cross pipes and at the bottom by the box on which they stand. Diaphragms are placed so as to compel the gas to pass up and down the tubes—the diaphragms having a few inches water seal. The gas enters the condenser at about 200° Fahr., and leaves it at about 60° Fahr. The gas then passes through the exhauster engines and thence through two liquor washers, where the last traces of tar and ammonia are removed.

The tar and ammoniacal liquor from the condenser and liquor washers is run into a separator, where the tar and liquor are separated by specific gravity and run into their respective stock tanks. The green tar thus obtained is pumped through the primary or tar washer to remove some of the water. The tar is then distilled. Ammoniacal liquor comes off first, and this is returned to the liquor stock tank. Then come light oils—specific gravity, ·950 to ·970. When these come off, what is left is pitch; and this is run into ponds. The ammoniacal liquor is heated with

steam to 140° Fahr., which removes the ammonia. This gas is passed into lead-lined saturators containing sulphuric acid, the strength of which is maintained by a constant feed of acid. The crystals of sulphate of ammonia collect at the bottom, and are blown out by a steam ejector into buckets with perforated bottoms. The liquid runs through, and the solid is trapped. The average yield per ton of coal used is: 4 to 6 gallons of oil, 20 lbs. of sulphate, and 120 lbs. of pitch.

After the inspection the company were entertained at tea.

Mr. JAMES JAMIESON (Greenock), the President, in moving a vote of thanks to the Company for their courtesy, and also to Mr. Mowat and his assistants, who had so kindly conducted them through the works, said he was certain that, though the production of pig iron was not directly connected with gas undertakings, still it was one of the great industries of the nation; and he had no doubt they had considerably benefited by their visit. They were very much indebted to Mr. Mowat and his assistants for their clear and interesting explanation of the plant.

The members endorsed these sentiments with enthusiasm.

Mr. MOWAT expressed his pleasure at being able to entertain the party, and hoped that they would benefit from what they had seen.

## Importance of Meter-Testing.

It was argued by Mr. F. J. Murmann, of the Westchester Lighting Company, in a paper which he submitted to the Empire State Gas and Electric Association, that from an economic standpoint the question of the periodical testing of consumers' meters is of vital importance to every gas company, since the revenue depends upon the registration of the meters. A variation in accuracy of registration is not attended by a corresponding variation in operating or production costs. A small percentage error in the total registration will sometimes mean a large percentage difference in the net revenue. While many of the larger companies realize the importance of this matter, there are still some who, while laying great stress upon the efficiency of other parts of the system, apparently quite overlook the inaccuracy of their meters. Meters operate under more varied and exacting conditions than most other pieces of apparatus; and, being mechanical devices, the natural tendency for them is to run slow. A company that has done little or no testing should be able to pay the expenses of doing it from the saving secured by the correction of slow meters. It is a matter of record that the accuracy of meters is more important from the standpoint of the company than it is from that of the consumer. Companies having thousands of meters in service for a number of years have found that approximately four times as many run slow as run fast. The consumer quite properly protects his interests by insisting upon having his meter tested when he suspects that he is paying for more gas than he receives; and the company, having four times as much cause, surely ought to protect its own interests by testing its meters. Another point in the argument advanced by him was that the periodical testing of meters will do much to maintain the confidence of the consumer, and will frequently prevent unjustified complaints of high bills.

## Pressure Distribution Charts.

The San Francisco gas distribution system was described, in a paper read at the last meeting of the Pacific Coast Gas Association, by Mr. W. M. Henderson, who dealt with both the high and low pressure portions of the business. Only the very remote areas are supplied with high-pressure service direct to the consumer. High-pressure gas, he said, carries a compression cost of about 6c. per 1000 c.ft., so the more the low-pressure system is used the better. Pressure conditions receive regular attention; high-pressure and low-pressure charts being collected each day from different sections. To put the system into the perfect operating condition, which a number of charts reproduced with the paper showed that it has now attained, has required a few years of close attention. The charts are used over each year for three years. They are filed by location; each gauge being fixed in a permanent place. The route of the chart collector is the same each day; and the charts of the corresponding day of the previous year are made-up for him each day. For each year a different coloured ink has been used—1918, red; 1919, green; and 1920, purple. This is good economy, as well as giving an excellent comparison of the pressure conditions for each year. Attention was drawn by the author to the progress made towards a uniform pressure, by proper control of the works pressure, in conjunction with the utilization of the governors on the high-pressure transmission system. The development of remote residential districts, with scattered homes, has created a field for high-pressure distribution; and this class of business can only be handled profitably by such a service. These consumers are supplied through individual regulators. In California, remarked Mr. Henderson, the provision of the Public Utility General Order covering gas service stipulates for a pressure not to exceed 12 in. or to be less than 2 in. At any individual service this pressure is not to vary in excess of 4 in. or 50 p.ct. of the maximum or minimum pressure registered. This is difficult to comply with unless the distribution system is large; and individual regulation may be necessary. It will profit any company to control the pressure and maintain it as low as good service will permit. Actual leakage of gas is thus reduced, and more accurate registration of meters is obtained.

# NOTES ON THE ORGANIZATION AND EQUIPMENT OF BYE-PRODUCT WORKS.

By HAROLD J. HAILSTONE, of the Rochdale Corporation Gas Department.

**[A Paper to be read before the Manchester and District Junior Gas Association on Feb. 5.]**

It is usual for all tar and liquor produced in the gas-works to be run to an underground tank, where it remains quiescent and warm; and, given satisfactory conditions, it should not be difficult, with normal tar, to obtain a separation down to 3 to 4 p.ct. water content. The tar is then pumped to an elevated store-tank for further settlement, and flows to the tar-stills for distillation. Modern practice indicates growing favour towards dehydration prior to distillation; and this is done either by separate continuous plant or by passing the vapours from an ordinary still through a condenser-coil contained within another still. Raw tar, being used as the cooling medium, becomes heated, and gives off its water together with some naphtha, and yields a hot, nearly dry tar ready for distillation in the ordinary still. Such dehydration enables bad tars to be dealt with in the main stills without the risk, difficulty, and delay otherwise encountered.

The ordinary intermittent still consists of an upright cylinder of riveted wrought-iron plates, having a concave bottom and convex top, and is made in various sizes from 10 to 30 tons working capacity. A convenient size, for 12-ton charges—*i.e.*, 2400 gallons—may be 9 ft. diameter and 9 ft. high. The side and top plates are $\frac{1}{2}$ in. to $\frac{9}{16}$ in. thick; while channel and bottom plates are $\frac{9}{16}$ in. to $\frac{5}{8}$ in. The method of construction of the bottom and channel is a matter of opinion. It may be either in one piece of pressed plate or in sections riveted together. Though the latter entails having more rivets in the heated area, and subject to corrosion, it has the great advantage that individual sections when worn can be taken out and replaced, without necessitating the removal of much of the brickwork setting.

With regard to the setting, such a still is placed, with a fall of about 3 in., on a seating-ring about 3 ft. above the grate-bars, the area of which need not exceed 9 to 10 sq. ft. In order to protect the bottom of the still from intense heat, it is usual to run a 4½-in. firebrick curtain-arch over the grate. In this way, no direct flame may come in contact with the still. Flues lead from beneath the still, and rise to the side flue which encircles the shell. A width of 9 in. and a height of 4 ft. to 4 ft. 6 in. is suitable; and, so as to allow for the periodical removal of dust, cleaning-out doors must be provided. The flue continues down the back of the setting, where a damper is inserted, and then communicates with the main flue to the stack. Firebricks are used only in contact with the heat; the remainder of the setting being ordinary brickwork, while the upper portion of the still is covered in with heat-insulating bricks. The whole setting should be so arranged that riveted joints can be readily bared for inspection where possible. This proves economical in the end, particularly when repairs become necessary. The time saved in thus obviating the dismantling of large parts of the setting and the cost of rebuilding are factors of considerable importance.

The still fittings consist of: A run-off pipe at bottom, usually 4 in. diameter, provided with a good gland cock. A charging-pipe with cock on one side. A manlid on top. A dipping-hole ½ in. diameter on top. A 1-in. steam-inlet pipe, with cock, passing through the top, and continued inside the still to the channel, where it is connected to a circular coil with ¼-in. holes 8 in. apart. A safety-valve of iron, of a simple and reliable character, easily accessible, with few parts, and no springs, to lift at 5 lbs. pressure. A vapour-pipe or swan-neck of cast iron, leading to a cast-iron condenser-coil. About 140 ft. of 4-in. diameter pipe should suffice for a 12-ton still. This is immersed in a tank provided with a 1-in. cold water supply sufficient to give the necessary cooling. The condensing-coil ends in a collecting-box, from the top of which runs a 2-in. connection to a foul-gas pipe. To the bottom are fitted connections with cocks to receiving or store tanks.

Continuous stills have become popular during recent years, and will deal effectively with very watery and "frothy" tars that give so much trouble in pot-stills. In the Wilton process, tar is superheated in a coil of cast-iron tube, through which it is pumped under pressure. It leaves the coil by way of a relief-valve, when all the water and naphtha, and some oil vapours, pass away to a condenser, while the dehydrated tar flows through a heat-exchanger to convenient receptacles. Another continuous plant—Hird's patent—consists of three or more heated horizontal cylinders of successively higher temperature. Through these the tar travels, and distillation takes place in each section. Water, light oil, and creosote are driven-off at successive stages; and the resultant pitch runs off through a heat-interchanger to the floor.

Pitch should not be run out into the open at a temperature above 130° to 140° C., on account of the escape of irritating fumes in excessive quantities. With pot-stills, the residue should be allowed to remain at least two hours in the still before running into a covered brick or iron tank, where it may further cool until ready for running to the floor.

The degree to which refining operations are carried will depend upon local conditions. In an industrial area, motor benzoles, naphthas (for paint and rubber industries), naphthalene (for firelighter trade), creosote (for fuel, lubrication, and wood-preserving

purposes), carbolic acids, tar varnishes, and road tars—all these have a market which will help in deciding the range of products to be manufactured.

The redistillation of light oils and creosotes takes place in pot-stills of a type already referred to, with or without the use of a fractionating column. The advantage lies in being able to separate last traces of naphtha and to bring practically all the recoverable carbolic acid and naphthalene into suitable fractions for subsequent extraction. Crude naphthalene or creosote salt is obtained by allowing a suitable oil fraction to cool in open-topped pans under cover. The time required for separation is influenced by the nature of the oil, the weather conditions, and the size of the tank used, and will probably be between seven and fourteen days, after which period the clear oil is drawn away from the bottom. When the pasty mass has completely drained, it is ready for sale or further treatment.

Carbolic acid is extracted from the crude naphtha, light oil, or redistilled creosote fraction by agitation with caustic soda in an iron vessel. The soda takes out the carbolic acid, and is run off from the bottom after settlement. This liquor, acidified in a lead-lined tank with B.O.V. acid, yields carbolic acid, which rises to the top, and is collected after running away to waste the slightly acid solution from beneath. Further washes of the oil will extract lower grades of carbolic and cresylic acids. An alternative method of liberating the carbolic from its soda solution is by means of a current of water-washed flue gas (containing 14 to 18 p.ct. $CO_2$ and no $SO_2$) until separation is complete. The use of B.O.V. acid is thereby obviated; and the regeneration of the remaining liquor, by treatment with lime, results in a big economy, as the consumption of caustic soda is thus reduced to a minimum. Continuous carbolic plants are on the market; and in these the simultaneous flow of oil and soda, through a mixing chamber, is adjusted to give a washing of the desired quality. In the ordinary type, agitation may be given by a mechanical stirrer, a circulating pump, an air blower, or a steam air-injector; but the whole plant should be arranged so as to make full use of gravitation.

After the extraction of these tar acids, the naphtha is distilled (if necessary), and is then treated with dilute sulphuric acid to remove basic oils (pyridine), followed by agitation with B.O.V. acid, and finally R.O.V. acid. This is done in a cast-iron vessel, with special precautions to avoid overheating, and to ensure the complete removal of waste acids after each treatment. The naphtha is given final washes with water and weak soda, to remove the last traces of acid, and is then ready for fractional distillation in a naphtha still provided with open and closed steam-coils. The various fractions of benzole, toluol, and naphthas are collected as required, and the residue run to the cooling-pans for naphthalene recovery.

In tar-works practice, there are three particular points to be kept in mind—namely, reduction of fire risks to a minimum, prevention of the escape of objectionable smells and poisonous gases, and avoidance of contamination of drains and sewers. Arising out of these and other considerations, it is inadvisable for plant to be unnecessarily cramped. Each general operation should be confined to its own area, so that in the event of fire or other mishap dangers may be more readily kept under control. The general lay-out of plant should be such as to minimize lengths of pipe-lines for steam, tar, oils, or naphthas, and so arranged that the final products are conveniently loaded-up, without excessive labour, to whatever conveyance is employed. In view of the fact that the raw materials and most of the intermediate products are liquid during manufacture, any differences in ground-level should be utilized where possible, in order to reduce pumping operations, and consequent steam consumption.

It is a good plan, when fitting-up general pipe-work, to interpose a number of flanges to facilitate disconnection when blockages occur—a not infrequent trouble, unless precautions are taken. Pipe-lines should have a continuous fall, and not sag in the middle; tee-pieces should be inserted at likely points for future branch-connections; steam should be connected to the various ranges for clearing deposits which are likely to form, particularly in cold weather; and drain cocks should be placed where necessary. For general use, gland-cocks are to be advised; plug-cocks not being suitable for tar products, as they rapidly become leaky. In this connection, it pays to use one reliable make, so that at any time if replacements are necessary there is no doubt about the new cock fitting the required place. Unfortunately, all makers do not appear to have agreed on standardization in the dimensions of fittings; and different makes will not always fit a given space—thus giving rise to extra pipe cutting and fitting.

The practice of indiscriminately burying pipes underground is to be deprecated, though in frosty weather it may appear to have advantages. Loss by leakage from such pipes tends to pass unnoticed for some time; and it is a better plan to carry the pipe on supports or in a properly constructed brick conduit, with loose cover. Any defective joints are thus easily accessible; and leakages can be recovered from sump-holes placed at intervals. The various pumps play an important part. All should be of reliable make, housed under cover. Branch connections on suction and delivery pipes are to be recommended, so that in cases of emergency—such as leakage of a tank, breakdown of another pump, fire, &c.—prompt connections can be made.

With regard to illumination, electric lighting is generally admitted to be the best for the tar-works, and in the vicinity of inflammable vapours should be fitted in a gas and water tight conduit, well earthed, all lights being enclosed in double gas-tight globes. Dark corners invariably become dumping grounds for accumulated rubbish, and are potential sources of danger.

The subject of fire prevention is an important one, and must be given adequate consideration. The nature of the materials is such that a fire once started is very difficult to extinguish, and liable to spread to surrounding plant. In the initial arrangement of the works, this matter should have received attention, as also in the details of fittings. Systematic examination of all plant, both external and internal, for signs of corrosion or weakness, becomes necessary. Rules as to smoking, carrying naked lights, &c., must be made quite clear, and cleanliness encouraged—any spills being cleared-up at the earliest opportunity. As it is the first few minutes that are the most important in an outbreak, it is advantageous to have some definite plan of operations. Specific duties having been allotted to selected workmen, and general instructions given to others, there need be no confusion when the fire alarm is raised. In many cases water is of no use on the fire itself, often doing more harm than good, but is applied in order to cool adjacent tanks, &c., and prevent the fire extending. Wet sacks, dry sand, and often ammoniacal liquor, to smother the flames, have their uses, and on a large works must always be available. The treatment of accidents—particularly burns and gassing—has to be provided for; and this entails the provision of suitable rescue apparatus—man-ropes, respirators, gas helmets, oxygen, and first-aid stores, together with all the necessary instructions as to their correct use.

Dealing with the chemical aspect of works' control, there is only time to consider general principles. Owing to the different qualities and values of tars produced from all grades of coals by diverse systems of carbonization, alterations in working-up have to be made. The numerous processes and plants through which the product will pass are the guiding factors in any scheme. A point to be emphasized in each operation is that the various distillates are "cut" in such a manner as to obtain the greatest concentration of individual products, in order to simplify later separation. The division points in the first distillation, yielding light oil, middle oil, creosote, or heavy oil, are adjusted on a quantity or a gravity basis founded on periodical examination of actual running samples taken at each end-point. These points are found to vary from time to time, depending upon the factors influencing the character of the tar. It is therefore important to keep a check on them, if losses are to be avoided and economical working maintained.

The same idea holds good concerning all fractional distillations, whether creosote, carbolic or cresylic acids, naphthas, &c.; each fraction being divided at a point determined by chemical and flask-distillation tests. The best results in working-up products can only be obtained in this way; and as there is also ample scope for investigation of plant and processes, an adequately staffed laboratory is essential.

In order to maintain output, check working operations, trace and prevent losses, and control working costs, some system of works' costing is essential. That most suitable consists of a "log" book, into which is entered the daily performance of each plant, including details of products, quantities, repairs, &c. From this source, together with the usual sales and wages records, can be collected any data for checking quantities of materials in stock, the cost of each operation during manufacture, and the costs of repairs and maintenance of plant. Such a system is a guide to possible economies in the use of raw materials or equipment, helps to show-up sources of loss and leakage, gives a record of individual work by men and plant, and provides a sound basis for correct judgment in the sale of the products—indicating which lines are profitable and which should be abandoned.

## An American Case-Hardening Furnace.

One of the special appliances made by the American Gas Furnace Company for case-hardening by means of gas, comprises two cylinders, one much smaller in diameter, and somewhat longer, than the other. The two cylinders are arranged to have their axes parallel, but not in coincidence. The outer one is provided with trunnions on two opposite sides; and these are mounted in suitable bearings on a metal stand. This arrangement permits of the pair of cylinders being tipped up or down for the purpose of facilitating the charging and discharging work. The outer cylinder is otherwise fixed in position. The inner cylinder, projecting at both ends, can, on the other hand, be rotated within the enveloping outer cylinder. The enveloping cylinder is of metal, and is lined with fire-brick. Gas and air are injected into the space between the inner cylinder and the outer one, and there burned; two rows of burners being used for the purpose. This space is the fire-box. One of the machines may be used by itself, or a battery of units may be operated.

**Gas in the Shipbuilding Industry.**—Issue No. 83 of "A Thousand-and-One Uses for Gas" should prove of much value, dealing as it does with "Gas in the Shipbuilding Industry." As the result of much labour, the Association have already in their possession sufficient matter to provide two complete numbers of the publication; and when some outstanding information from a Norfolk yard is to hand, there should be enough material for a third. In the present issue the San Francisco Bay industry is dealt with. The subject of rivet-heating—which, of course, is applicable to other branches of work, as well as to shipbuilding—is receiving very full treatment in these articles.

## STUDIES IN THE DISTRIBUTION OF MINERAL MATTER IN COAL.

In a paper on this subject which was read by Dr. R. LESSING, F.C.S., at a meeting in Doncaster last Saturday of the Midland Institute of Mining, Civil, and Mechanical Engineers, he pointed out that in a previous paper read by him before the Chemical Society on the "Mineral Constituents of Banded Bituminous Coal,"* he showed that the principal ingredients of bituminous coal which can be recognized and separated vary considerably, not only as regards total percentage of mineral matter in them, but that the ashes obtained upon their ignition exhibit considerable and characteristic differences of composition. The work forming the substance of the paper referred to was carried out on the four ingredients—fusain, durain, clarain, and vitrain.

The investigation of the mineral constituents of these substances was prompted by results, hitherto unpublished, which the author had obtained in experiments in connection with an investigation of the coal-washing process. These had shown that the fractions separable from coal-slack by washing differ vastly, not only in the amount, but also in the nature, of the mineral matter which they contain. He thought it interesting and opportune to bring the results of this and subsequent investigations before the Midland Institute as having a very important bearing on the efficiency of coal-washing processes, and the economic utilization of coal in general. It is considered by him to be of the highest importance to impress upon the coal producing and consuming industries the necessity for investigating the nature of the impurities associated with ordinary coal. It would be a fallacy to regard the ash in coal merely from a quantitative point of view as a certain amount of inert matter. One need hardly enlarge upon the influence of composition of ash on its fusibility and general behaviour during combustion; but he thought it might be worth while to draw attention to the catalytic influence which certain mineral ingredients must have upon the spontaneous combustion, and particularly upon the carbonization, of coal. This point was discussed by Dr. Lessing at length in his William Young Memorial Lecture, in 1914,† when he showed that there is much evidence that the ash-contents of coal play an important part in its thermal decomposition. The possibility of a catalytic influence which the mineral contents of decaying vegetable matter, and the adventitious inorganic material in contact therewith, may have had during the process of coal formation, is a question of more academic interest.

The author drew attention to the fact that, in the investigations on bituminous coal from the thick seams at Hamstead Colliery, it was shown that the percentage of ash in clarain (the portion of bright coal still containing plant débris) and vitrain (the bright coal of conchoidal fracture, without recognizable structure) was fairly constant; that the variation of ash-content in durain (the dull, hard coal) was much more marked; while that of fusain (the equivalent of "mother-of-coal" or "mineral charcoal") showed very considerable discrepancies between different samples. The following were the average figures obtained: Fusain, 15·59 p.ct. ash; durain, 6·26 p.ct.; clarain, 1·22 p.ct.; and vitrain, 1·11 p.ct. On separating the ash from each ingredient into three portions—water soluble, acid soluble, and acid insoluble—and submitting each of these to complete chemical analysis, the differences were found to be not less marked than those of the composition of the various fractions. He laid emphasis upon the important bearing of the results on the question of the removal of inorganic material from coal by means of washing, and the need for investigation on an extended scale in the directions indicated by these previous researches; and as a contribution towards the solution of the many problems, he submitted some results of the investigations carried out eight years ago, which gave rise to his earlier paper. Striking differences in the ash content of dust and dirt were shown by a table of results obtained from samples of unwashed and washed slacks from North Staffordshire collieries; and these differences, said the author, become still more marked upon ocular examination of the ash specimens obtained. The low specific gravity of the clean coal, together with the low ash figure of about 1·6 p.ct., shows that the clean coal obtained in the tests represents practically clarain and vitrain. The purpose for which the tests were made was to ascertain the amount of good coking coal in the samples, though it was realized that the fraction called "dirt" would still contain a certain amount of coal substance, probably of the nature of durain.

The "dirt" from two samples was subdivided into light, medium, and heavy portions; and one outstanding fact shown by this subdivision is that the ash contributed to the entire sample by the dust was at least equal to, and in some cases more than twice as much as, that contributed by the whole bulk of the clean coal, though the dust portion itself only ranged from 6 to 9 p.ct. of the bulk of the sample. It may, Dr. Lessing went on to say, be confidently assumed that the whole of this dust is, during the operation of washing, detached from the coal particles, and kept suspended in the water. Any dust found on the washed coal must therefore be due to deposition of dust on the coal in the collecting sump, or to the intentional addition of settled slurry to the washed slack. The quantity of dust or slurry thus going forward with the coking slack is on an average of the order of 5 p.ct. of the total. While the complete removal of dirt is dependent on the construction and working of a washer, and may not be possible, or even intended in all cases, he suggested that the removal of the dust portion could be effected with the greatest ease, and would be a simple and desirable mode of improving the quality of coking slack. All that is required is not to allow the fine particles suspended in the water to settle on the washed coal, and to refrain from reincorporating deposited slurry with it. He believes these dusts consist of a large proportion of fusain, which is wholly devoid of coking properties. Moreover, it yields (if any) much less bye-products than the bulk of the coal. It is also detrimental to efficient and speedy drainage of water from the washed slack. He suggested that the slurry deposit should be utilized in the direction for which it is most suited—namely, for coal-dust firing in cement works and elsewhere, or possibly for burning in admixture with liquid fuel.

The author then dealt at some length with the analysis of ashes, and remarked that the facts which he had submitted in his paper had been put forward in order to prove the insufficiency of information obtainable from the customary ash test performed in ordinary coal analysis. Coal is such a composite material that no trustworthy opinion of its intrinsic value can be formed without due consideration being given to the character of its ingredients and the ratio to each other in which they occur.

The mineral constituents of coal, he said, are the least desirable ones from the consumers' point of view; and hence their study acquires particular importance. The inorganic portions differ so much in their composition and behaviour, that it is hardly permissible to neglect their detailed investigation. Such investigation should apply to every stage of coal production and coal consumption; for there is hardly a point at which the influence of the mineral ingredients does not make itself felt. Their presence determines in the first instance the workability of a seam; they influence the production of dust in the workings and roads of a mine; and they have considerable bearing on the problem of spontaneous combustion, both as assisting such combustion, and, in the form of stone dust, as preventing or abating the danger.

Once the coal has come to the surface, the ash contents largely determine its value. The comparatively rough methods of coal-cleaning and coal-washing are capable of great refinement. For this purpose, a detailed study of the dirt constituents is absolutely essential, if the methods of detachment and separation of dirt from clean coal are to be improved, and the recovery of such bye-products as pyrites is to become general. The effect of the ash on carbonizing in coke-ovens and gas-works has already been discussed; and the need for more knowledge in this direction has been pointed out before.

Where coal is gasified or burned in gas-producers, the influence of the proximate and ultimate composition of ash is of the utmost importance. Fusibility tests on small average coal samples obtained by quartering and grinding, are of little value in showing up the behaviour a coal is likely to have in a gas-producer. If, however, a detailed examination is made of the composition and distribution of the ash, an opinion can be formed as to the likely behaviour of this coal under gas-producer conditions. As a proof of the practical value of investigations of this kind, Dr. Lessing stated that he has been able to predict the suitability or unsuitability of coals for gas-producers in a large number of cases by the examination of the coal constituents on the lines he had now described.

Coal-dust firing is another branch of fuel consumption the success or failure of which depends entirely on the elimination of ash constituents or those portions which are detrimental to the heating apparatus or the material to be heated. The same remark applies to the more recent proposal of firing together coal or coke dust and liquid fuel, in the form of mechanical suspensions or emulsified by the addition of colloidal substances.

The field for investigation is therefore a very wide one; and there is room for plenty of serious workers for the collection of facts and figures in regard to these problems, if ever we are to enter the often-prophesied era of fuel conservation.

* See "JOURNAL," Vol. CXLIX., p. 188. † *Ibid.*, Vol. CXXVII., p. 570.

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**Street-Box Explosion in London.**—There was an explosion on Tuesday morning of last week in an electricity distributing box at the corner of Whitcomb Street and Orange Street, off the Haymarket; the shock shattering the windows of several shops near-by. The main explosion was followed by others in quick succession; the covers of manholes being blown out of their sockets. There was no outbreak of fire. There seems to be no information as to whether the explosion was caused by coal gas, sewer gas, or gas generated by the electric cables themselves.

**Imperial Continental Gas Association Payment.**—In order to prevent misunderstanding, says "The Times," it is advisable to point out that the latest payment made to the Imperial Continental Gas Association through the Enemy Debts Clearing Office does not presage any immediate further distribution to the stockholders. The amount just received by the Association is £885,368. This further instalment brings the total received to date from the Clearing Office to a figure approaching that for which the relative properties were liquidated; and any further sums will have to come by way of the Reparations Department. There can now be no question of a further distribution—over and above the 20 p.ct. net that has been paid, and the 60 p.ct. return of capital due to be made in March—until the accounts have been prepared and submitted to the proprietors at the meeting in May next. These accounts will cover the period from July, 1914, to Dec. 31, 1920.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by Correspondents.]*

## Strike Quality of Gas Supply—Who Inspired It?

SIR,—I have been endeavouring for some weeks past to obtain, through the medium of the columns of the "JOURNAL," some information as to who were the inspirers of the damaging order as to the strike quality of the gas supply which was so deservedly pilloried by Mr. Alderman A. H. Hobson at the meeting of the British Commercial Gas Association. So far I have been unsuccessful.

But I have been reminded that the answer to the inquiry could probably be furnished by those members of the Advisory Committee appointed by the Government who were selected as representatives of the gas industry. I cannot believe that these gentlemen are ashamed of any advice they may have given; and having regard to the fact that, wittingly or unwittingly, injury was caused to the whole industry and a blow below the belt struck at this Company, I am justified in asking for an explanation of their action.

CHARLES CARPENTER.

*South Metropolitan Gas Company,*
*Jan. 25, 1921.*

## Sutton Gas Company Amalgamation.

SIR,—I enclose herewith copy of a letter I have to-day sent to Mr. Ferguson Bell on the above matter.

HY. E. JONES.

13, *Queen Anne's Gate, S.W., Jan.* 20, 1921.

[ENCLOSURE.]

J. Ferguson Bell, Esq., *Jan.* 20, 1921.
Uttoxeter Road, Derby.

Dear Sir,—Replying to your letter of the 15th inst., through the "GAS JOURNAL," I write to ask you what you call my "one-sided propositions." You ought to know that the only two sides of a statutory company are the *consumers* and the *shareholders;* and until something *extra is done for the consumer*, nothing can be got for the shareholder.

How is the consumer in Sutton to benefit, so long as the Sutton Company pays 13s. a ton more for the coals than the Wandsworth Company? This question cannot be ignored, and may be sprung on the shareholders *by the Sutton consumers;* as we have seen by a late conviction of a Sussex Company.

Will you show me, but specially the shareholders, how it is possible for them to make any profit out of the amalgamation beyond improving the prospect of lowering the price of gas (when every penny reduction to the consumer will give one-eighth per cent. more to the shareholder), according to the bargain which already exists in the Act of the Company? Do you really suppose the Board of Trade are going to release any of the companies from the present obligation in that respect? I think the shareholders ought to be told this, and perhaps you will reflect on it. Otherwise you will find that you have misled them into rejecting the finest prospect for their benefit that is ever likely to be open to them, as you must very well know.

You must recall that I was the first to inform you of the proposed amalgamation, and explained that, if you held an appointment of a fixed sort (as I judged from your name being on the balance-sheet), your interests would be protected by a clause in the Bill—which, in fact, is now there. At that time your views were strangely *different* from those which you have *found convenient to express later;* and whether you consider a reply to me necessary or not, I trust the *consumers* of Sutton (who have the first and largest share in any future benefit), and the shareholders, will compare your former with your present attitude of mind.

As to your position, you told me you had a fixed remuneration, and that you would have a percentage upon the extensions of the Company, which you enumerated as purifiers, gasholders, land, exhausters, &c., within the next few years. These you appear now to say are not at all necessary.

You went on to say, very creditably, that you realized *the day for comparatively small, isolated companies had gone*, and *that individual interests must give way to the interests of the community*, and, further, that your Derby Company had absorbed five small companies (which I knew), and that you felt sure that I should do the right thing by you—as I commenced by explaining I should always do, especially in the case of a fellow professional man.—Yours obediently,

(Signed) HY. E. JONES.

SIR,—It seems almost incredible that Mr. H. E. Jones should write such over-statements as appeared in your last issue.

Mr. Jones more than once made a careful inspection of the Sutton works, and knows full well they are up-to-date, well kept, and that the working results compare favourably with Wandsworth. I find, as a matter of fact, from the last published returns, under the sum expended on repairs, renewals, and maintenance of works for the ten years 1910 to 1919, the average for Sutton is 6·17d., and Wandsworth 5·65d. For mains, services, and meters during the same period, Sutton 4·21d., and Wandworth 4·22d. per 1000 c.ft. sold. Thus, for repairs and maintenance of works, mains, meters, &c., the total for Sutton is 10·38d., and for Wandsworth 9·87d.

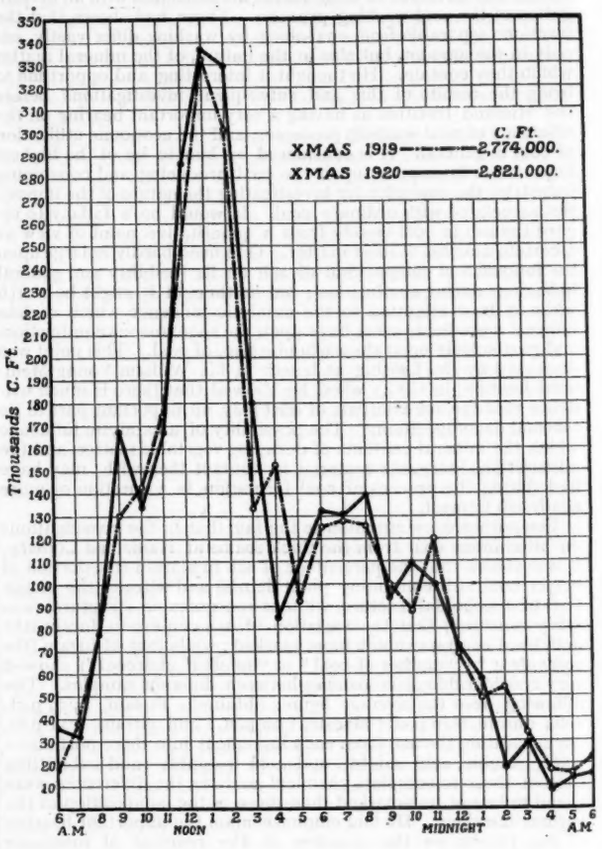
In view of these figures, it is evident that to state £18,000 is required to be expended at Sutton for deferred repairs—representing no less than 7½d. per 1000 c.ft. spread over two years—is a palpable exaggeration. I think most engineers will agree that an average expenditure over ten years of 10·38d. per 1000 c.ft. for repairs and maintenance, indicates that the works plant, mains, and meters must have been reasonably well maintained; and this is the case. In the three years 1910-11-12, no less than £15,144 was taken from undivided profits towards the cost of special renewals; and during the last three years 1918-19-20, nearly £5000 was written off for depreciation on meters, stoves, and fittings. This is the Company Mr. Jones would have your readers to believe is in a bad way, but which he is eager to purchase at his own price.

With strange inconsistency, Mr. Jones insists on the sacredness of a parliamentary bargain. Yet in this session of Parliament the Wandsworth Company are promoting a Bill to obtain, among other things, relief from a bad bargain entered into by the Mitcham and Wimbledon Company, when in 1912 that concern, along with the Epsom and Ewell Company, was amalgamated with the Wandsworth Company.

*The Gables, Derby, Jan.* 24, 1921. J. FERGUSON BELL.

## Use of Gas-Cookers in Winter.

SIR,—The question as to whether gas-cookers are used in winter has sometimes been discussed. My experience is that, where gas-cookers are installed, they are used throughout the year—though possibly in smaller houses more in summer months than in winter months.




The record of hourly consumption which I am sending you shows what an important factor the gas-cooker represents; and if you think it would interest your readers, you are at liberty to make use of it. The consumption per hour for cooking is higher on Christmas Day than any other hour of the year.

THOS. GLOVER.

*British Gas Light Company, Ltd., Norwich,*
*Jan.* 17, 1921.

[The record of hourly consumption which Mr. Glover is now good enough to forward has a bearing upon a portion of his Presidential Address in 1909 to the Institution of Gas Engineers. He then gave a table showing the monthly and yearly ratios for certain years of day consumption to total consumption in Norwich, remarking upon the interest of the figures, as "an unusually high proportion of the gas consumers of Norwich are provided with cooking-stoves." The flexibility of gas-fuel supply is here very clearly demonstrated.—ED. "G. J."

## Enclosed Type Oven Efficiencies.

SIR,—In perusing the Jan. 5 issue of the "JOURNAL," I became very interested in Mr. Heathcote's lecture before a meeting of the Yorkshire Junior Gas Association, on "Cooker Research." Upon the major portion he is to be congratulated; but what a pity it is he did not tackle the oven question from a more practical point of view!

Referring to his Table No. 1, the question of heating-up a cooker in the shortest possible time presents little or no problems, and is of very little importance. Obviously, such tests could have but one result—viz., that the more B.Th.U. you push through the cooker, taking into consideration the capacity of same, the greater would become the temperature. The problem that presents itself to-day is efficiency with economy—or, in other words, what is the minimum consumption of gas to maintain the correct temperatures for cooking with the least

amount of shrinkage to the joints, and the retention of flavour and natural juices?

Referring again to Table No. 1, some of the poor cookers show, apparently, a high efficiency; while the other better-class cookers show rather badly. It is certainly far preferable to start-up the oven slowly, and work-up to the required temperature. It avoids heavy condensation, which, in the case of the popular open-bottom stove, is continuous, owing to the fact that there is no control of the secondary air, and the hot air will find its way out, even if it has to go down again. This means a continuous supply of cold and moist air, and consequently quick variations of temperature. The cooking is saturated, causing heavy shrinkage and taint; and, further, such conditions require continual attention and control on the part of the cook to secure good results.

I quite agree with Mr. Heathcote that all recent experience goes to show that, with the modern burners, we get complete combustion, and very little secondary air is required to give a sufficient pull to the flue to prevent flooding. What we want to-day is a packed cooker of the enclosed type, which gives an opportunity for effectually controlling the secondary air. It should also have an automatic control of gas in conjunction with the required temperatures. Whether you have an outside or a centrally disposed burner chamber does not much matter. A downwardly directed flue is certainly an advantage, and helps considerably towards the problem of regeneration. As regards the open crowns, the air-space between is quite a good insulation; and it is a debatable point as to which are better—open or packed crowns.

Referring to the discussion, Mr. Cawthra "hit the nail on the head" in his remarks; and, further, I entirely agree with Mr. Packer with regard to the design points, and also his further remarks on standardization. Until we have more finality, standardization is only a bar to progress in the gas-cooker world.

I give below two tests of ovens of an enclosed type, which may be of interest to your readers:

*Calorific Value* 550 *B.Th.U.*

| | Degrees. | Consumption. |
|---|---|---|
| First 10 minutes .. | 300 .. | 20 c.ft. per hr. |
| ,, 20 ,, .. | 360 .. | 12 ,, ,, ,, |
| ,, 30 ,, .. | 360 .. | 9 ,, ,, ,, |
| ,, 40 ,, .. | 460 .. | 20 ,, ,, ,, |

*Calorific Value* 550 *B.Th.U.*

| | Degrees. | Consumption. |
|---|---|---|
| First 15 minutes .. | 320 .. | 19·5 c.ft. per hr. |

Continuing at 10 c.ft. per hour maintained the above temperature.

In conclusion, I hope when Mr. Heathcote comes out again he will give us some practical tests on the points mentioned. He might even go so far as to invite the Institution to partake and judge for themselves the results of such tests.

E. MORGAN.

32, *Cromer Road, Tooting, S.W., Jan.* 17, 1921.

## Cost of Smoke in Pittsburgh.

It is estimated by Superintendent A. C. Fieldner, of the United States Bureau of Mines, that smoke costs every man, woman, and child in the Pittsburgh district $20 a year. It has, he says, been reckoned that it costs this much for extra laundry work, for paint to renovate smoked walls or woodwork, and for cleaning and materials for the purpose. Therefore every citizen who used smokeless fuel would get value for doing so. The country would be much the gainer if all soft coal were coked. It would add millions to the wealth of the country, and save both the natural gas and coal supplies. The demand now for coke is so great that the important steel companies are building large batteries of ovens. From the soft coal, these will take enormous quantities of gas, which can be mixed with natural gas by the gas companies, and so used to conserve the natural gas supply. The need for coke-ovens is, however, growing beyond the ability of these concerns to catch-up with it. A ton of soft coal yields 70 p.ct. of coke, 9 to 10 gallons of tar, 5000 c.ft. of gas, 25 lbs. of sulphate of ammonia, and 3 gallons of light motor oil. Birmingham (Ala.) does most of its cooking and lighting by coke-oven gas, which sells for $1 per 1000 c.ft. These remarks were made in connection with the recommendation by the Smoke Reduction Bureau, the Chamber of Commerce, and the Bureau of Mines of a new fuel which has been tested, and which is a combination of coke dust and particles of soft coal. While it is not known how much of this coke breeze is available, there are said to be many hundreds of tons accumulated at the numerous coke-ovens in the Connellsville and other fields; and, of course, further quantities are being made daily.

**Gas Poisoning Case in Belfast.**—"Death due to heart failure following asphyxia," was the verdict of a Belfast Coroner's Jury, in the case of Wm. Cairns, aged 86. The evidence showed that deceased was subject to fits; and the theory was advanced that he had gone into the kitchen, while alone in the house, to light the gas at the gas-ring, and that he had just turned on the gas when he fell in a fit. Later he was found lying on the floor; the room being full of escaping gas. The Coroner and Jury said they regarded the occurrence as purely accidental.

**No Rise in Price Anticipated at Wandsworth.**—An official of the Wandsworth, Wimbledon, and Epsom District Gas Company informed the "Daily Telegraph" that they did not anticipate a rise in price from 4s. 2d. per 1000 c.ft. in the near future. Owing to the fact that the Company, through its geographical situation as an up-river undertaking, had never been exporters of coke, the falling-off in value of this bye-product had not affected the Company as much as it had some other London Gas Companies. The Company had a very small capital, and had always been economically managed. Then they had a fleet of boats which brought coal from Durham direct to the wharf at Wandsworth; and there had been a big saving in the costs incurred in contractors' bills for discharging the ships and barging the coal from the lower reaches of the Thames. The five boats belonging to the Company conveyed 225,000 tons of coal yearly to Wandsworth.

# REGISTER OF PATENTS.

## Low-Temperature Distillation of Coal.—No. 134,529.

YOUNG, N., of Frankfort-on-the-Main, Germany.

No. 25,276; Oct. 15, 1919. Convention date, Nov. 1, 1918.

This invention relates to the low-temperature continuous distillation of coal in a continuously rotated retort in the form of an inclined hollow drum, which is sealed against ingress of air and heated externally and/or internally. The retort is provided with continuously acting means for feeding-in the coal and discharging the coke and for leading away the fuel gas evolved; the object being "to enable low-temperature tar—*i.e.*, tar containing a large proportion of the viscous oils—semi-coke, and fuel gas to be obtained from the coal concurrently and without risk of the retort becoming choked owing to the clogging effect due to the softening of the coal."

The operation is conducted at a temperature between 500° and 550° C. in a retort of the kind already mentioned; while, in order to prevent clogging of the retort when the coal becomes pasty, to obviate the employment of mechanical stirring devices or worm-conveyors for maintaining movement of the material undergoing treatment, to cause the coke to become disintegrated as the retort revolves, and to increase the effective heating surface within the retort, the latter is provided internally with heavy crushers (in the form of iron balls) which roll round with the contents of the retort during its rotation.

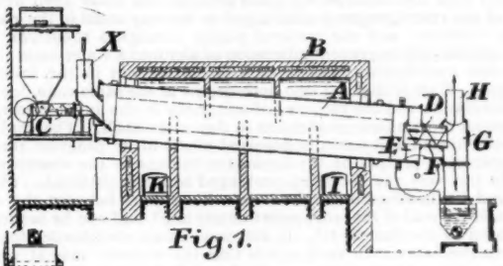


Fig.1.

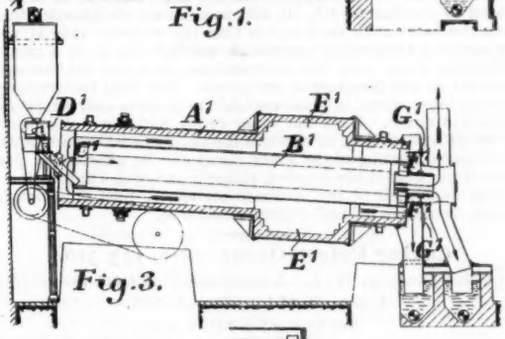


Fig.3.

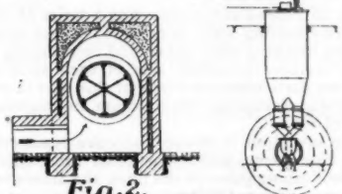


Fig.2.


Fig.5.

Fig.4.

**Young's Low-Temperature Carbonization Plant.**

Fig. 1 is a longitudinal section, and fig. 2 a cross section of the one form. Fig. 3 shows the other form in longitudinal section, fig. 4 in cross section, and fig. 5 in end elevation.

In figs. 1 and 2, a rotary retort in the form of an inclined hollow drum is employed, surrounded through nearly its whole length by brickwork B. The coal is introduced through the feed opening of the drum, by a device forming an air-tight seal. This can be effected by glands, &c., or by a worm C, which also enables the drum to be charged without admission of air. The discharging device is also constructed in such a way as to prevent admission of air. A small pipe D is attached to the delivery end of the drum; and the coal deprived of gas within the drum is lifted by vanes E into this pipe, and is conveyed by the worm F in the pipe to the discharge-head G. The entry of air through the discharge-head is prevented by the slides, by the column of material allowed to accumulate, and by a water seal. The escaping high-grade fuel-gas tar-vapours are drawn off at the delivery end of the drum through the pipe D and the exhaust pipe H, for further treatment.

In the example shown, the coal is treated on the counterflow system. The heating gases enter the brickwork flue at I, and escape at K. Guide and baffle walls are arranged in the brick flue in such a way that the gases are utilized to the utmost. In this case, where the heating is effected from outside, the drum is not lined, but is provided with a partition in the same way as is known in connection with drying-drums. The heating can also be effected from the inside, by passing the hot or superheated gases from a producer through the drum, into the upper end of which the gases are introduced by a pipe X.

In this case the distillation is accompanied by an enrichment, or increase in the heating value, of the gases traversing the drum. More-

over, the two methods of heating—external and internal—can be used in combination. For example, the waste gases escaping at a high temperature from a blast-furnace can be used for heating the drum externally, and coke-oven gas for the internal heating. The gases may be passed through the drum in one direction or in counterflow.

Instead of the waste gases from a blast-furnace being employed for the purpose, the external heating may be effected by means of a furnace; and, instead of the coke-oven gases, the gases from a producer may be passed through the drum. The drum may also be heated by the fuel gas discharged at H.

The resulting semi-coke may be made into briquettes—the necessary disintegration being effected in the drum itself by means of the crushers (iron balls or the like) employed therein. By this means increased heat-transmission is obtained.

In the modification illustrated in figs. 3 to 5, a rotary retort is also used; but in the form hereafter described, in order to obtain the best results as regards the production of gas and semi-coke, the partial distillation of one portion of the coal and the recovery of the semi-coke are combined with partial or complete gasification of another portion. The rotary retort consists of a lined external shell $A^1$, provided with a widened portion $E^1$, and of an inner drum $B^1$ similar to the drum A or retort of fig. 1. The charging device at $C^1$ is again arranged in such a way as to prevent the admission of air, and at the same time allow both the drums $A^1$ and $B^1$ to be charged. Above the feed-pipe is a charging device $D^1$ constructed in such a way as to prevent access of air. Charging devices such as are used for producers or any other kind of furnace can also be employed here. The inner drum $B^1$ (or retort proper) is discharged in the same way as in fig. 1. The final product from the intermediate space between the outer shell and the wall of the retort proper is discharged in the way usual in the case of rotary furnaces; and the material passes through a sheet-iron head (also constructed to prevent admission of air) into a water-tank.

In this modification, the process is carried out in the following manner: Coal is charged into both drums at the same time, for partial distillation and the recovery of semi-coke in the inner retort, and for partial or complete gasification in the outer shell. The coal that has been heated and partially deprived of gas in its progress through the preceding portion of the apparatus collects in the chamber $E^1$; and in this way the necessary prolonged action is obtained. The air required for combustion in the intermediate space between the outer shell and the wall of the inner retort enters at $F^1$, and can be accurately regulated by the damper $G^1$. In this way, means are afforded for conducting the process in such a way that the material may at will be either partially distilled, or completely gasified just as in a producer. The escaping gases from the intermediate space are led through the inner retort in the direction of the arrow. The heat for distilling the coal in the inner retort is generated by the process carried on in the intermediate space. Both the inner retort and the outer shell are provided with partitions, to improve the efficiency of the apparatus.

The internal heating of the inner retort can be effected by passing through it gas from other sources, either alone or in conjunction with the gases generated in the intermediate space, part of which latter gases may be drawn off and utilized elsewhere.

## Coking Retort-Ovens.—No. 155,316.

MELLERSH-JACKSON, W. J. A communication from the KOPPERS COMPANY, of Pittsburg, U.S.A.

No. 15,803; June 23, 1919.

This invention relates to coke-ovens, comprising a series of coking chambers with intermediate heating-walls constituted of two series of combustion flues laterally abutting each other and respectively contiguous to the coking chambers on either side of each such wall. Certain features of it relate particularly to ovens of this type in which the flues are of substantially triangular cross section, as disclosed in British Patent No. 7664 of 1911.

The main object of the invention is to apply to coke-ovens certain features of the Koppers coke-ovens, and in particular those concerning the distribution of the burning gases in the flues, the arrangement of regenerators, and the means for operating the ovens either as "coke-ovens" or as coking "gas-ovens," as disclosed in the Koppers patents No. 28,811 of 1904 and No. 8725 of 1911.

Other objects are to provide means for adapting such ovens to the conditions of operation obtaining in a Koppers coke-oven, to increase their flexibility of operation, to reduce their cost of maintenance, and to increase their durability and resistance to the strains and variations of the high temperature and other operating conditions to which they are subjected.

The invention provides a coking retort-oven of the type referred to, having one or more of the following features: It has flues substantially triangular in cross section, and connections arranged to supply gas and air to continuous rows of both series of flues fired simultaneously in each heating-wall. Above each series of flues there are combustion products conduit means separate from such means above the other series, for conducting the products from one to the other of the groups of flues occupying the halves of the length of each heating-wall.

Means are also provided for preheating the air or both the air and the gas; the oven then comprising air-regenerators, gas-regenerators, and communications that directly connect each flue with both an air-regenerator and a gas-regenerator. The regenerators may be disposed crosswise of the battery of ovens, and arranged under the soles of the coking-ovens in double pairs—separately communicating with the flues grouped in the respective halves of the length of each heating-wall.

## Retaining Device for Coke from Vertical Retorts. No. 155,750.

PIETERS, J., of Paris.

No. 22,350; July 27, 1920.

This invention relates to apparatus for the actual retention of the coke resulting from continuous vertical retorts. Instead of being directly supported at the bottom of the retort by mechanism which is consequently obliged to pass through the material, it is merely sustained by being wedged between two jaws or series of jaws arranged on each side at the base of the retort and adapted to project within the retort as two inclined surfaces in opposition to one another. These jaws are preferably located in hollow beams or box-girders beneath the separating piers between the retorts, supporting the weight of the whole superstructure of the retort—the jaws being withdrawn to the interior of the hollow beams to allow the drawing of the retort.

Fig. 1.

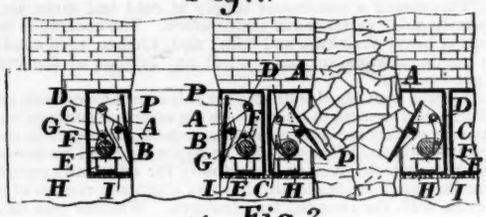


Fig. 2.

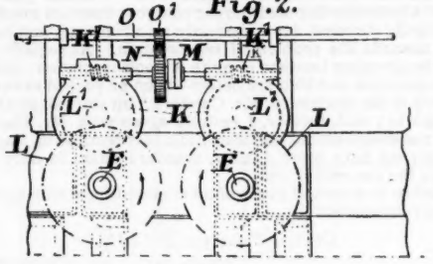
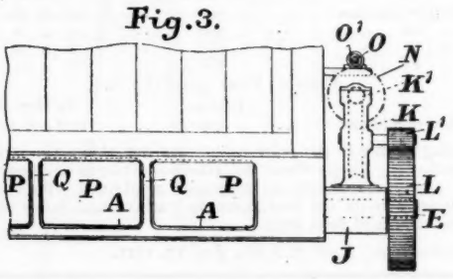


Fig. 3.



Pieters' Coke Retainer for Vertical Retorts.

Fig. 1 is a transverse section of the lower part of a battery of retorts—showing on the right the arrangement of the jaws during the closure, and on the left the position in which the jaws are withdrawn into a hollow beam during the fall of the coke. Fig. 2 is a side elevation of the mechanism for operating the jaws. Fig. 3 is a view in axial longitudinal section at the bottom of the retort, affording a front view of one of the two series of jaws withdrawn into the centre of the beam during the fall of the coke.

At the bottom of the retort and on each side of it, are jaws of cast-iron or steel plates A pivoting upon axes B carried in suitable bearings [not shown]. The jaws face one another at the bottom of the retort and on each side, below the brick piers which separate the different retorts of the battery. The jaws are controlled by links C oscillating around axes D and operated by a shaft E by means of very short cranks F fixed upon the shaft and pivotally connected at G to the rods or links. The operating shaft E is carried in a number of bearings [not shown]. All bearings supporting the pivotal axes B of the jaws, as well as the operating shaft, are secured upon a single longitudinal girder H, which thus carries all the operating mechanism. It may be completely independent of the box-girder I within which the jaw and its operating mechanism are enclosed; and so the girder I supports the weight of the brickwork and superstructure of the walls forming the retorts. The movable girder H, carrying the operating mechanism, is fixed within the hollow girder I by wedges between the two.

The girder H is extended beyond the end of the retort at J (fig. 3) to form a seating for the speed-reducing gear which drives the main shaft E. Upon each of the shafts E is keyed a toothed wheel L meshing with a wheel $L^1$, keyed upon a countershaft parallel to the shaft E and carrying a worm-wheel K meshing with a worm $K^1$—the shafts of the two worms driving the main shafts E of a single retort being coupled directly together at M; while upon the shafts are keyed toothed wheels N meshing with pinions $O^1$ carried by a common shaft O serving to operate the whole of the retorts. The speed-reduction gears are arranged so that the two shafts E of a single retort revolve in opposite directions.

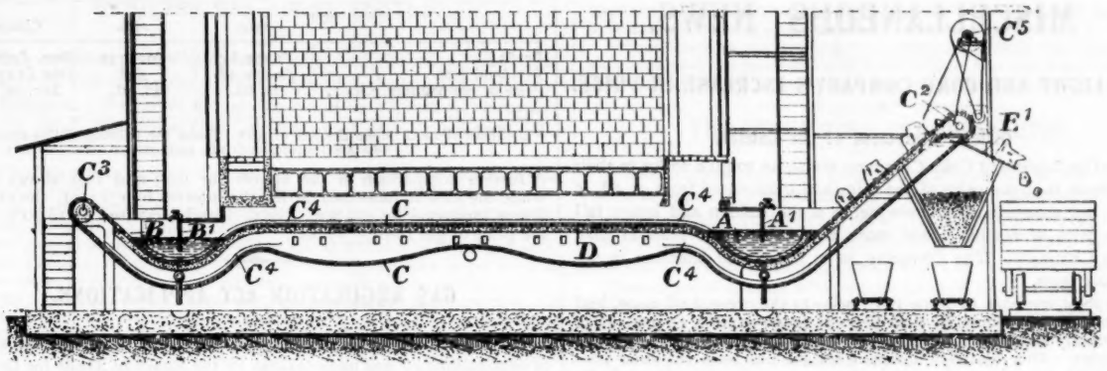
The hollow girder I upon its side facing the retort presents a number of openings P for the passage of the movable jaws. These openings are separated by fixed parts Q of dimensions sufficient to withstand the vertical load resting upon the girder. Each pier—that is to say, each dividing wall between two retorts—is thus supported at its base by two hollow girders, allowing the accommodation of the retaining mechanism of two adjacent retorts.

## Discharging Coke at the Base of Vertical Continuous Retorts.—No. 155,751.

PIETERS, J., of Paris.

No. 22,351; July 27, 1920.

This invention relates to apparatus for discharging the coke at the base of continuous vertical retorts, and allowing it to be conveyed




Pleters' Vertical Retort Coke Discharger.

directly outside the retort to the "vehicles on which it is to be loaded."

As compared with known apparatus for discharging the coke from the whole length of the retort, the present invention is characterized by the fact that the hydraulic seal which prevents leakage at the base of the retort—instead of extending to form a large reservoir closing in the whole of the bottom of the retort, and in which the coke would therefore have to remain for a considerable time—consists simply of two small reservoirs arranged at the sides of the retort and into which the coke passes only for a few moments while being conveyed by an endless transporter.

The retort is sealed at its lower end by two water-spaces A B of relatively small dimensions, into which there dip metal partitions $A^1$ $B^1$ so as to provide a hydraulic seal. The reservoirs are arranged on the centre line of the retort and on either side of it, outside the retort chamber. The discharge of the coke is effected by an endless conveyor consisting of two side chains C connected by slats $C^1$. The conveyor extends over the whole length of the retort, as far as the driving and idler drums $C^2$ $C^3$; the latter being adjustable in position to allow the endless chains to be properly tensioned.

The coke rests on the flooring D by means of the slatted chain, and can only come into contact with the water during the short time necessary for passing through the water-seal reservoir A at the side where the coke is discharged.

The conveyer chains C are guided in their travel beneath the retort as well as in their passage along the curves of the water-spaces A and B by sliding and protecting surfaces suitably arranged at $C^4$. The endless transporting device $C^1$ conveys the coke directly to the wagons, preferably after first making it pass over a riddle consisting of a sieve in order to remove the finer particles, which fall into a hopper.

The conveyors of an entire battery of retorts may be operated by means of a single shaft $C^5$ extending along the retorts on one side and driving the several drums by suitable transmission.

## APPLICATIONS FOR PATENTS.

**[Extracted from the "Official List" for Jan. 19.]**

Nos. 1134 to 2216.

ACHURCH, F.—"Gas heating apparatus." No. 2199.

AMERICAN COKE AND CHEMICAL COMPANY.—"Reflex coke oven, and method of preheating or conserving waste heat." No. 1552.

AMERICAN COKE AND CHEMICAL COMPANY.—"Bye-product condensers." No. 1553.

ASH & Co., LTD., T.—"Gas, &c., heating-stoves." No. 1954.

BAILEY, C. J.—See Ash. No. 1954.

BATES, L. W.—"Method of producing gas." No. 2212.

BOARDMAN, F.—"Steaming and aeration of vertical retorts by alternating cycles." No. 1810.

BOYER, J. F.—"Incandescent gas-burners." No. 1877.

BROOKE, R. M.—"Apparatus for manufacture of gas." No. 1984.

BROWN, D. A.—"Atmospheric gas-burners." No. 1173.

CHEMISCHE FABRIKEN WORMS AKT.-GES.—"Distillation." No. 1575.

COLLIER, A. P.—"Automatic gas-signalling apparatus." No. 2011.

CRITCHLEY, J.—See Brown. No. 1173.

DICKSON, D. B.—"Gas-producers." No. 1774.

DINGLER'SCHE MASCHINENFABRIK AKT.-GES.—"Purifying gases." No. 1532.

DOLENSKY, E.—"Gas-producers." No. 1587.

FORD, W. H.—"Geyser." No. 2066.

FOSTER J.—"Method of producing lime for building, together with ammonia and a gas for power purposes." No. 1690.

GROSSE, C.—"Gas, &c., purification." No. 1682.

GUNDRY, W. L. D.—"Lighting gas-fires by means of electricity." No. 2165.

HABER, E.—"Device for propelling gases by centrifugal blowers." No. 1380.

HERNU, H.—"Gas-generators." No. 1197.

HERNU, H.—"Apparatus for purifying and treating gases." No. 1198.

JACOBS, K. W. J. H.—"Production of gas-coal substitute." No. 1511.

JACOBS, K. W J. H.—"Recovery of methane." No. 1778.

LORD AND SHAND, LTD.—See Gundry. No. 2165.

M'INDOE, R. W.—"Prepayment meters." No. 1953.

MADDEN, H. D.—See Boardman. No. 1810.

MARCHANT, H. S.—"Burner for incandescent gas lights." No. 1773.

MOON, P. G, G.—See Boyer. No. 1877.

NIELSEN, H.—"Plant for distillation of carbonaceous materials." No. 2120.

OAKLEY, S.—"Air-regulators of incandescent gas-burners." No. 2034.

POLYSIUS, G. [Firm of].—"Low-temperature carbonization." No. 1230.

RASCHIG, F.—"Recovery of benzole hydrocarbons from coke-oven gas." No. 1509.

RAYBOULD, A.—"Antivibration devices for inverted gas-burners." No. 1140.

RIPPL, F.—"Continuous distillation or gasification of organic matter." No. 1528.

SELAS-TURNER COMPANY, LTD.—"Gas-fires." No. 2144.

SKITTEN, C. M. & R.—"Gas fire-lighter." No. 1825.

SOUTH METROPOLITAN GAS COMPANY.—"Treatment of waste liquor from wet extraction of copper." No. 1790.

SPINDLER, F. G.—See Oakley. No. 2034.

TAUNTON, R. P.—See M'Indoe. No. 1953.

TURNER, E.—See Selas-Turner. No. 2144.

VANDERLINDEN, H. J.—"Geyser." No. 2056.

WALKER, W.—"Apparatus for converting light into heat energy." No. 2139.

WEIGHT, O. W.—See South Metropolitan Gas Company. No. 1790.

WHITWORTH, W.—"Apparatus for manufacture of gas." No. 1984.

# LEGAL INTELLIGENCE.

### Damage to a Lamp-Standard.

In the local County Court, the Newmarket Gas Company sued George Heaseman, motor car proprietor, for £12 15s. 2d. in respect of damage to a lamp-standard and lamp which were knocked over and broken on Sept. 1 by a wagon belonging to Mr. A. Hawes, of Wicken: it being alleged that one of the horses drawing the wagon was frightened through the negligent driving of defendant's car. His Honour Judge Farrant found that there was no negligence on the part of defendant's driver, and gave judgment in his favour, with costs.

### Kilkenny Lighting Contract.

In the King's Bench Division of the High Court of Ireland, before Mr. Justice Ross, an application was made in the case of the Kilkenny Gas Lessees, Limited, against the Mayor and Corporation of Kilkenny, under the Courts Emergency Powers Act, for an order annulling the contract between the Lessees and the Corporation with regard to the lighting of the city. The contract was entered into in 1909; and since then the price of materials—especially coal—had increased to such an extent that it was impossible for the Gas Lessees to continue to carry out the lighting. The contract was for a period of fifteen years. The lighting of the city had actually cost the Gas Lessees £1260 a year; and they were losing £760 on the contract. They asked for relief by annulment, or at least that the contract might be suspended for a period. His Lordship said the applicants might leave the city in darkness at any moment, if he annulled the contract. Mr. Sayne (for the Corporation) suggested that suspension was more likely to lead to a settlement. His Lordship then suspended the contract until further order, with liberty to apply for annulment if a settlement were not arrived at between the parties. He expressed his opinion that an agreement should be come to. Mr. Swayne believed that once the parties began negotiations, the matter would be satisfactorily settled.

**Tully Gas Plants, Ltd.**—A Company having this title has just been registered with a capital of £150,000 in £1 shares. Of these, 100,000 are 8 p.ct. cumulative participating preference shares.

**Halifax High-Pressure Charges Reduced.**—On the recommendation of the Gas Engineer (Mr. W. B. M'Lusky), the Halifax Gas Committee have decided to recommend a reduction of 6d. per 1000 c.ft. for gas used by consumers on the high-pressure lighting system, which was introduced in Halifax the year before the outbreak of war, and was progressing greatly until the war put a stop to lighting development of all kinds. The reduction is really the removal of a surcharge originally fixed to meet the needs of the new development; and it is hoped that the abolition of the charge will encourage old users of high-pressure lamps to develop, and others to try the system. It is stated also that the price of Halifax gas as a whole is expected to be reduced by 6d. per 1000 c.ft. from April 1.

# MISCELLANEOUS NEWS.

## GAS LIGHT AND COKE COMPANY'S INCREASE IN PRICE.

### Official Statement of the Causes.

The Gas Light and Coke Company are about to give notice to their consumers that the price of gas is forthwith increased from 4s. 8d. to 5s. 6d. per 1000 c.ft., as a consequence of the sudden and heavy fall in the price of residuals, and more especially in the price of coke on the Continent. The Company, in so doing, call attention to the following facts.

The total increase in price that, prior to the present advance, had been made by the Company since pre-war days—namely, 87 p.ct.—was substantially less than the increase in other household and industrial necessities. This relatively low price for gas has been rendered possible mainly by the largely increased revenue from the bye-products of gas manufacture—coke, tar, and sulphate of ammonia—and especially from coke sold for export from the Company's Beckton works, which are favourably situated on the estuary of the Thames for export trade. The receipts for bye-products during 1920 amounted to no less than £4,800,000, as against £1,250,000 in 1913.

The entire benefit of this increase has been enjoyed by the consumers of gas in the Company's area, with the result that the price has stood at 4s. 8d. for fifteen months, in spite of considerable advances during this period in wages and in the cost of coal. That the shareholders derived no advantage whatsoever from the higher revenue from coke, tar, and sulphate of ammonia is evident from the fact that the dividends paid in 1920 were less by £360,000 than those for the year 1913.

Gas companies alone among all the industrial concerns in the kingdom distributed smaller profits out of largely increased revenue as a result of the war. The whole of the Company's increased revenue, *plus* part of the pre-war dividends, went to pay for the extra cost of labour, coal, oil, freight, and materials required for the upkeep of the Company's works.

Now there has come about a tremendous slump in the price of coke for export, as well as a sag in the price of tar and its products, and of sulphate of ammonia. Accompanying this is the great probability of a rise in the price of coal in the home market, to meet the increase in miners' wages *plus* the serious fall in the price of coal exports. This revolutionary change in the financial situation as it affects the Company has come about with extraordinary and startling rapidity, as a result of the world-wide depression in trade, the state of the foreign exchanges, the abnormally mild winter, and the increased supply of coal, partly from our own mines, partly from Germany and America.

The effect upon the Gas Light and Coke Company, as upon other coke-exporting companies—such, for example, as those on the North-East Coast—is so immediate and tremendous that they are obliged to take the unusual step of announcing an increase in price during, instead of at the end of, a quarter, and taking special readings of the meters from which the altered price will date. The increase which the Company are making—namely, from 4s. 8d. to 5s. 6d. per 1000 c.ft.—will not, by a considerable figure, meet the estimated decrease in revenue for the current year. In view, however, of the many uncertain factors in the industrial and financial situation, the Directors, anxious not to aggravate the difficulties from which all consumers are already suffering by any increase in costs that can possibly be avoided, have decided to make the smallest increase in price that they feel to be absolutely imperative at this juncture. In the meantime, they will draw upon the Company's reserves to meet any deficiency.

It should be remembered that now that (under the Gas Regulation Act, 1920) the sliding-scale comes again into operation, the Company's dividends will vary inversely with the price of gas—that is to say, the higher the price the lower the dividend—an arrangement whereby the interests of the consumers and the shareholders alike depend on the economical administration of the business. The public can therefore rest assured that the price is not being, and will not be, raised a penny more than is absolutely necessary, and will be reduced again at the earliest possible moment.

### Expenditure Trebled.

Referring to the matter in Monday's issue, "The Times" added the subjoined figures:

The Company's books are by Statute subject to the audit of the Board of Trade's Accountant; and the following figures have just been passed. They clearly set forth the change which has taken place since 1913 in the relation of the price of gas to profits.

INCOME.

| | 1913. | 1920. | Increase. |
|---|---|---|---|
| | £ | £ | |
| From gas, &c. | 3,751,374 | 7,778,085 | .. |
| Residuals | 1,249,228 | 4,839,214 | .. |
| Total | £5,000,602 | £12,617,299 | £7,616,697 |

EXPENDITURE.

| | 1913. | 1920. | Increase. |
|---|---|---|---|
| | £ | £ | |
| Coal, oil, &c. | 2,254,330 | 7,284,095 | .. |
| Wages and salaries | 1,254,736 | 3,845,036 | .. |
| Rates and taxes | 320,639 | 574,633 | .. |
| Total | £3,829,705 | £11,703,764 | £7,874,059 |

| | 1913. | 1920. | Change. |
|---|---|---|---|
| Profit | £1,170,897 | £913,535 | Dec. £257,362 |
| Dividend p.ct. | £4 17s. 4d. | £3* | Dec. £1 17s. 4d. |
| Price of gas per 1000 c.ft. | 2s. 6d. | 4s. 8d. | Inc. 2s. 2d. |

* Dividend allowed under the Act of 1918. Under the existing sliding-scale, the dividend would be £1 12s. p.ct. only.

A further comparison of the figures for 1913 and 1920 shows that, while the income increased during the interval by 152 p.ct., the expenditure increased by 206 p.ct., the dividend decreased by 38 p.ct., and the price of gas rose by 87 p.ct.

## GAS REGULATION ACT APPLICATIONS.

The following further notices appear in the "London Gazette" of applications by gas undertakings to the Board of Trade for Orders under section 1 of the Gas Regulation Act.

### Harwich Gas and Coke Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 7s. 1d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 2s. 6d. per therm.

### Redhill Gas Company.

The standard prices now authorized in respect of the supply of gas by the undertakers are (*a*) 3s. 6d. per 1000 c.ft. within the borough of Reigate as existing on May 25, 1900, with a neutral zone down to 3s. 2d. per 1000 c.ft.; and (*b*) 4s. per 1000 c.ft. outside the borough of Reigate as then existing, with a neutral zone down to 3s. 8d. per 1000 c.ft. The prices which they have asked the Board of Trade to substitute for these are: (*a*) 1s. 5·6d. per therm within the borough of Reigate as then existing as aforesaid, with a neutral zone down to 1s. 4·8d. per therm; and (*b*) 1s. 6·8d. per therm outside the borough of Reigate as then existing, with a neutral zone down to 1s. 6d. per therm.

## MANCHESTER GAS PROPOSALS.

### A Poll to be Taken.

It has been decided by the Manchester City Council, at a special meeting, to take a poll of the ratepayers upon the gas and other clauses of their Bill which was defeated by a town's meeting, as stated on p. 171 of last week's "JOURNAL." It was further agreed that the gas clauses (including power to purchase the undertaking of the Stretford Gas Company) and the traffic regulation clauses shall be placed separately on the ballot paper; the opinion being that if they were placed together the known contention that exists about the traffic clause might defeat the proposal to purchase the Stretford gas undertaking, which is held to have the unanimous support of the citizens.

The Lord Mayor (Alderman William Kay) said the Gas Committee had agreed to purchase the Stretford gas undertaking; and the Council were bound to use every endeavour to promote a Bill to complete the purchase. About 520 polling-stations would be necessary under the new regulations; and the cost would be exceedingly heavy.

It was remarked by Alderman Bowie that the ratepayers were represented at the town's meeting by 400 people. The proceedings were a farce.

The poll will take place on Feb. 1.

## EDINBURGH GAS ENGINEERSHIP.

In view of the forthcoming retirement of Mr. Alexander Masterton, the Edinburgh Corporation Gas Engineer and Manager, the Gas Committee recently decided to recommend that applications for the appointment of Engineer and Manager be invited by advertisement, and that the question of continuing the services of Mr. W. R. Herring as Consulting Engineer be delayed meantime.

In reply to a question at the Council meeting on the 19th inst., when the recommendation was submitted, the Convener of the Gas Committee (Mr. Stewart) said that it was not proposed to state a definite salary. Treasurer Deas remarked that it was suggested that there were certain persons connected with the Gas Department who might be applicants, and that none of them would be successful if a salary higher than that at present paid to the Engineer was stated. If this were so, it meant that they were not on the look-out for the best man; and the situation with regard to the gas supply in the city pointed to the need of getting an engineer with the highest qualifications. They wanted a man thoroughly capable of managing the whole business on his own responsibility. They should therefore offer inducements to attract the right men. The advertisement should be in a form that would ensure this. Mr. Stewart thought that the matter should be left in the hands of the Committee. The usual procedure had been to promote members of their own staff, if they were competent.

After further discussion, it was eventually agreed to remit the matter to the Committee, with instructions to keep these points in view.

**The Proposed Engineers' Club for London.**—Among the names in the Provisional Committee which is being drawn-up in connection with the proposed Engineers' Club for London [*ante*, p. 172], are those of Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., Sir W. Peter Rylands (President of the Federation of British Industries), and Mr. W. J. U. Woolcock, M.P. (of the Association of British Chemical Manufacturers). Mr. Thomas Goulden (President of the Institution of Gas Engineers) has also been nominated to serve on the Committee.

## HAMILTON GAS-WORKS VISITED.

The Hamilton Gas-Works had a visit last Saturday week from a large number of members of the Physical Society of the University of Glasgow. They were met at the works by Provost Sir Henry S. Keith, Mr. J. Ballantyne (the Gas Manager), and his Assistant (Mr. D. Robb), who conducted the party over the works.

The inspection began at the railway siding, where the coal is tipped into the receiving hopper by hydraulic rams. From there it is conveyed to the storage hoppers of the vertical retorts, or into the coal-store, by Babcock and Wilcox gravity bucket conveyors, of which there are three on the works. The coal is withdrawn from the coal-store by the same conveyor that puts it in store. The lower limb of the conveyor passes through a tunnel underneath the coal-store floor, along which are shoot-valves at regular distances apart, so that the coal can be withdrawn from any desired point. A minute inspection was made of the Woodall-Duckham vertical retorts, the working of which was fully explained to the party, who were greatly interested in seeing the coal charged into the retort at the top, and the coke withdrawn at the bottom in a comparatively cool state—the whole operation being carried out automatically.

The condensers, exhausters, purifiers, station-meter, and governors were next inspected, so that the making of gas was followed from the time it is evolved from coal in the retort until it is sent out to the town ready for use. Considerable interest was taken by the members in the process of eliminating and dealing with the tar and ammonia produced by the works. The tar is treated by a Wilton continuous tar-dehydration plant, the working of which was fully explained. By means of this plant the crude tar is rendered fit for road-making purposes, and creosote oil and crude naphtha are recovered. The creosote oil and crude naphtha are obtained by distillation on the first run, and separated by fractional condensation, as the plant is supplied with two condensers and separators. The sulphate of ammonia plant and its working details were also fully explained.

A member of the party, on behalf of the Society, proposed a vote of thanks to the Town Council for allowing them the privilege of inspecting the works. He said he was sure they would all benefit thereby. For his own part, he had not previously known much about gas manufacture; but he had learned from the visit a great deal that was instructive and interesting, and thanked the officials who had conducted them through the works.

Sir Henry S. Keith responded, and stated he was pleased the Council were able in any way to assist the Association in its quest for knowledge. With regard to the gas undertaking, he would say that they had always endeavoured to keep the works up-to-date. They could see for themselves that the raw material was brought in and dealt with, until finally it was sent out in the form of coke, without being touched by hand. It had always been the aim of the Council to have the best plant in the gas-works, and to keep abreast of the times, as it meant efficiency and economy of production.

Mr. Ballantyne also replied, and pointed out that, from his experience, it sometimes paid to scrap plant which had not been very long in use, if a more up-to-date appliance could be substituted for it.

## THE NEW WORKS FOR DUMBARTON.

A commencement is being made with the erection of the new gas-works for the burgh of Dumbarton. The ground acquired is at Dumbuck, and extends in area to 8½ acres. It is practically level, and has good rail and road facilities. A double line of sidings will be put down; and traffic will be handled inside the works by two electric capstans.

The carbonizing plant is to be the Glover-West system of continuous carbonization, with a capacity of 750,000 c.ft. per day, complete with coal and coke handling plant and coal-store. Condensers, scrubber, tar-extractor, and exhausters will be transferred from the old works—these being modern, and of ample capacity. The purifiers are by Messrs. Clapham Bros., Ltd., of Keighley, four boxes in line, each 30 ft. by 25 ft. by 5 ft. deep, fitted with Clapham's patent "Triumph" valves. The station-meter and governor are to be transferred from the old works.

The Barrowfield Iron-Works, Ltd., of Glasgow, hold the contract to erect a three-lift spiral-guided gasholder in steel tank, with a capacity of 750,000 c.ft. A Lancashire boiler will be installed, 30 ft. by 8ft. by 6 ft.; and the present boiler is to be removed and fitted-up alongside, for stand-by purposes. The tar-well is planned for a capacity of 100,000 gallons, and is of reinforced concrete. The meter, governor, and laboratory are to be housed in one building.

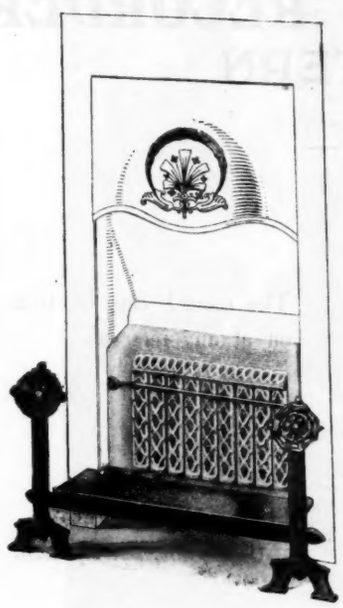
On the street frontage, a range of buildings comprises offices, stores, workshop, smithy, men's mess-room, and bath and lavatory accommodation. Other buildings include an exhauster-house and a boiler-house. No time will be lost in getting the work carried through, under the supervision of Mr. James Bell, the Engineer and Manager.

## TRADE NOTE.

**[For "Journal" Advertisers.]**

**The "Revergen" Gas-Fired Plate-Heating Furnace.**

The Davis Furnace Company, of Luton, have in course of erection at a well-known locomotive works in the Leeds district a "Revergen" furnace 8 ft. long by 6 ft. wide by 18 in. high, for plate and angle-bar heating prior to bending. The order for this furnace was placed after very exhaustive trials had been carried out by the purchasers to satisfy themselves as to the suitability of this type of furnace for the work. It is hoped the furnace will be running early in February.

# The Main "Entente" Gas Fire.

## An Appreciation.

"The three 'Entente' Fires supplied to me are most satisfactory in every way, and the burner is all you claim for it. I was rather doubtful before I had tried it whether it would be right at varying pressures, but have found it to adapt itself to all pressures and calorific powers without lighting back. I have had plenty of opportunity to test it during the past fourteen days, due to the coal strike and consequent reduction in quality of gas supplied.

"The Fire has a most pleasing effect when supplied with gas of standard pressure and quality. The fuels are fully heated to the top at a regular temperature, from bottom to top, not simply bright for the first three inches and the remainder quite dull.

"*You can certainly recommend them with every confidence to your customers.*"

# R. & A. MAIN, LTD.

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 24.

In the absence of business, prices of tar products in the London Market continue more or less nominal. The demand for pitch still bangs fire; but it is felt that the value of the article is in the neighbourhood of 175s. per ton net f.o.b. makers' works. Creosote is called from 1s. 2d. to 1s. 2½d. per gallon net in bulk. Pure benzole and pure toluol are 4s. per gallon filled into buyers' drums. Solvent naphtha is about 3s. 3d. to 3s. 6d. per gallon. In other products, there is nothing fresh to report.

The position of sulphate of ammonia remains unchanged.

### Tar Products in the Provinces.

*Jan.* 24.

The market for pitch is still very dull; and although it is known that a considerable quantity is required by consumers, at present they appear to be determined to hold off the market. In consequence of this, all figures which are quoted are purely nominal, and no prices of pitch can really be taken into account until genuine business is again transacted. Benzole and toluol are quiet. The demand for motoring purposes has apparently slackened. Solvent naphtha is dull; but prices should improve with better business in the rubber trade. Creosote is quiet; but there are several railway orders in the market which may somewhat improve the demand. Naphthalene is decidedly quiet, and there is little or no demand. Carbolic acid appears for the present to be practically unsaleable; and the prices offered by consumers are below the cost of production.

**The average values for gas-works' products during the week were:** Gas-works coal tar, 105s. to 115s. Pitch (all pitch prices are purely nominal) East Coast, 170s. to 175s. per ton f.a.s.; West Coast—Manchester, 170s. to 175s.; Liverpool, 170s. to 175s.; Clyde, 170s. to 175s. Benzole 90 p.ct. North, 2s. 11d. to 3s.; crude 65 p.ct. at 120° C., 2s. 3d. to 2s. 5d. naked at makers' works; 50-90 p.ct. naked, North, 2s. 11d. to 3s. 1d. Toluol, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 1s. 1½d. to 1s. 3d. Solvent naphtha, naked, North, 2s. 10d. to 3s. Heavy naphtha, North, 3s. to 3s. 2d. Creosote, in bulk, North, liquid, 1s. to 1s. 0½d.; salty, 11½d. to 1s. Heavy oils, in bulk, North, 1s. to 1s. 1d. Carbolic acid, 60 p.ct., 1s. 10d. to 2s. Naphthalene, £35; salts, £10 to £12, bags included. Anthracene, "A" quality, 1s. per minimum 40 p.ct.; "B" quality, nominal.

### FROM A MARKET CORRESPONDENT.

### Tar Products.

There is very little new business doing in tar products; and no improvement in the general situation is to be reported. Indeed, values in some directions are inclined to ease further. The depression in patent fuel has caused a further falling-away in pitch; and the outlook is somewhat uncertain. There is still a small inquiry from the Continent for shipment over the next three months; but buyers' ideas of prices are considerably lower than are asked by sellers. The South Wales briquette works are mostly closed-down; and in any case the railways are not very willing to carry pitch—pleading congestion, although it is doubtful whether this is the real reason. Naphthalenes are more or less nominal; and there is very little business done in these lines. There is certainly a demand for the crude qualities from the firelighter trade. But it is not very large; and prices seem likely to be lower. In refined qualities, conditions are even worse than with crudes. Solvent naphtha has a weak tendency; but there is no actual change in quotations. Heavy naphtha is in moderate demand. Creosote is reported somewhat weaker. The market for carbolic acid is quiet; although there does not seem to be any definite change since last report. Cresylic acid, however, is easier; and benzoles are irregular, with a movement towards slightly lower quotations. There is very little fresh in intermediate products. Business is on the quiet side, and values generally are maintained. Salicylic acid is stagnant, at a reduction of about 2d. per lb. Aniline oil and salts are without change.

The range of quotations is as follows:

**Benzole:** 90% London 3s. 10d., North 3s. 7d. to 3s. 9d.; 50-90% 3s. 3d. London, 3s. to 3s. 1d. North; crude 60-65%, 2s. 3d. to 2s. 5d.; pure, 3s. 3d. per gallon naked.

**Crude Tar:** London, 105s. to 115s.; Midlands, 107s. 6d. to 112s. 6d.; North, 105s. to 107s. 6d. per ton *ex* works. Refined tar, 85s. per barrel (free) on rail.

**Pitch:** London, 200s. to 205s. per ton f.o.b.; East Coast, 195s. to 200s. per ton f.o.b.; West Coast, 195s. to 200s. f.a.s., with Manchester 200s. per ton, and Glasgow 195s. per ton; South Wales, 210s. per ton.

Solvent Naphtha: 2s. 9d. per gallon.

**Crude Naphtha:** Naked, 11d. to 1s. 1d.; North, 1s. per gallon.

**Heavy Naphtha:** 3s. 2d. per gallon.

**Naphthalene:** Refined flake, £24 to £28 per ton nominal; inferior, £25; crude, £10 to £15 per ton, according to quality.

**Toluol:** Naked, 3s. 4d. per gallon nominal; North, 3s. 2d.; pure, 4s.

**Creosote:** London, 1s. 2d. to 1s. 3d.; North, 1s. 2d.; heavy oil, 10½d. per gallon in bulk.

**Anthracene:** 40-45%, 1s. 3d. to 1s. 4d. per unit per cwt.

**Grease Oils:** 18° Tw. (naked), £6 5s. per ton f.o.r. makers' works.

**Pyridine:** 18s. to 22s. 6d. per gallon.

**Aniline Oil:** 1s. 7d. per lb., drums extra.

**Aniline Salts:** 1s. 9d. per lb.

**Cresylic Acid:** Crude, 2s. 6d.; dark 95-97%, 3s. 3d.; pale 97-99%, 3s. 9d., per gallon, drums free.

**Carbolic Acid:** Crude 60%, 2s. 3d. per gallon; crystals 40%, 8d. per lb. nominal.


# SIMMANCE'S DEAD BEAT RECORDER

## TAPE CHART PATTERN

**For Pressure or Vacuum.**

**NO LIQUIDS USED.**

The chart roll is renewed 6 times a year.

The record can be torn off at any interval.

Lowest Range: 0-2 inches water.

Highest Range: 0-300 lbs. per sq. inch.

Suitable for Gas, Air, Water, or Steam, and may be used on Crude Gas.

**MAKERS:**

**ALEXANDER WRIGHT & Co., Ltd., WESTMINSTER**

Salicylic Acid: Technical, 1s. 8d.; B.P., 2s. per lb.
Xylol: Pure, 4s. 3d.; commercial, 3s. 9d. per gallon.
Resorcin: 7s. 6d. to 8s. 6d. per lb.; pure, 21s. per lb.
Alizarine 20%: 2s. per lb.
B. Naphthol: 2s. 6d. per lb.

### Sulphate of Ammonia.

Some substantial inquiries have come on this market as a result of the revised prices which brought liberal terms into force, and quite a fair demand is in evidence in the home market. There are very few signs of improvement on the export side, and values continue to fall away. The price obtainable at the moment for export is £26 per ton, while the price for home consumers remains at £23 16s. I understand that, in view of the considerable amount of criticism which has been directed against the recent reduction in the prices of sulphate of ammonia, the British Sulphate of Ammonia Federation have arranged to meet the members of the National Association of Corn and Agricultural Merchants on the 1st prox., in order to examine cases in which merchants are alleged to be making a loss owing to reduction in the spring prices of sulphate. The Federation claim that they are under no legal liability to make any allowances whatsoever; but they are always willing to enter into friendly discussion with representative bodies of traders in regard to any grievances they may feel.

**Danger of Open Gas-Taps.**—At a Hammersmith inquest, it was stated that, when Reginald Clarke, of Shepherd's Bush, went to bed, on Saturday week, the gas in his room, supplied by a penny-in-the-slot meter, went out while he was undressing; and he got into bed in the dark. Soon afterwards his brother, in another room, put several pennies in the meter, with the result that during the night the gas escaped in deceased's room, and next morning he was found dead in bed. Medical evidence showed that death was due to coal-gas poisoning; and it having been stated that the meter and fittings were in perfect order, the Coroner recorded a verdict of "Accidental death."

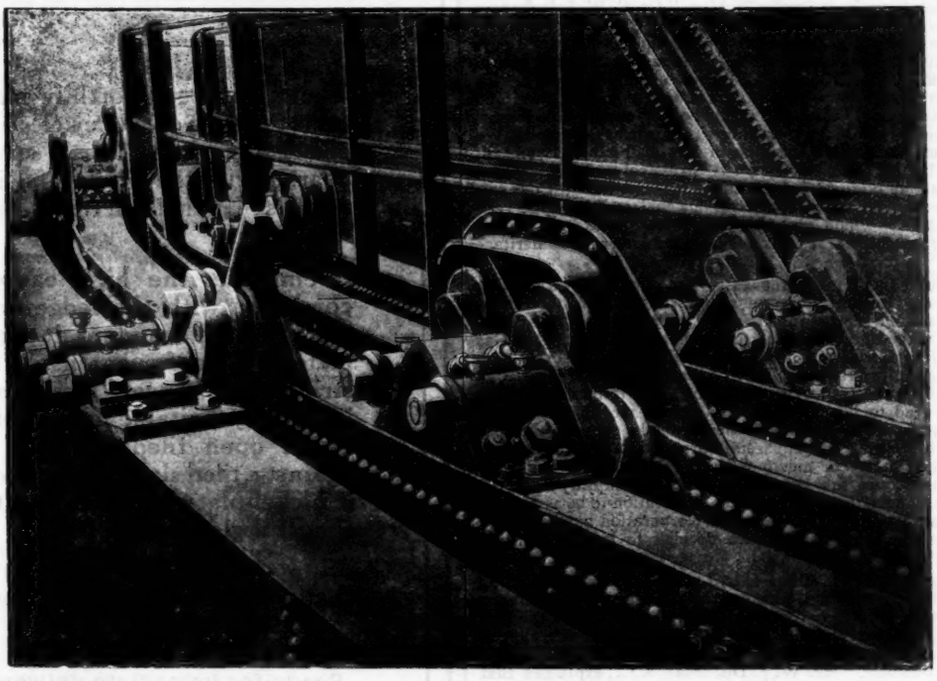
**Heanor Council and the Gas Company.**—There was a great deal of criticism at a meeting of the Heanor Urban District Council held some days ago, as to the quality of gas supplied to the area by the Langley Mill Gas Company. The Chairman (Mr. C. B. Wood) reported that several members of the Council had visited the gas-works; and they found the coal which was allowed to the Company by the authorities to be of such a rubbishy nature that it was extraordinary that it would produce any gas at all. He moved that the Council should ask for the supply to the Gas Company of suitable coal, so that Heanor could be served with satisfactory gas. Mr. Keeling said the proportions of coal allowed were 66 p.ct. inferior, 4 p.ct. intermediate, and 30 p.ct. ordinary quality gas coal. He had examined the coke breeze, and found that only about 1 cwt. in every ton was real coke; the remainder being rubbish, and showing the poor quality of the coal. The Chairman's resolution was carried.

### Forthcoming Gas Exhibition in Leeds.

As was mentioned in last week's "JOURNAL," it is intended to hold a first-rate gas exhibition in Leeds from Feb. 15 to 26. Manufacturing firms are taking great interest in the scheme, which is also being very well received by the engineers and managers of the surrounding districts. Attention is being drawn to the exhibition by Mr. C. S. Shapley (the Engineer and General Manager to the Leeds Corporation Gas Department), through the medium of some excellent posters and stamps. A special feature will be the lectures promised by Prof. Arthur Smithells, B.Sc., F.R.S., Mr. H. M. Thornton, Assoc.Inst.C.E., M.Inst.Mech.E., Major Wheeler, and Mr. F. W. Dye. Everything points to a highly successful exhibition.

**Gas Fuel in Manchester Houses.**—Referring in the "Manchester Guardian" to the use of gas for heating and cooking, and the reduction of coal fires to a minimum, to lessen the smoke nuisance, Miss Marion Fitzgerald says the new Manchester Corporation houses are being constructed on this principle. There are two coal-grates only in the new houses—one in the living-room (of the ordinary sitting-room type, not a kitchen range), and one in the bedroom over it. The parlour and the other bedrooms have gas-fires. There is a gas cooker in every scullery, and also a gas copper for boiling clothes. The domestic hot-water supply is obtained from a boiler at the back of the sitting-room grate in those houses where there is no central hot-water supply. These arrangements comply with recommendations made by the Manchester Women's Advisory Committee on Housing and by the Women Citizens' Association, whose members are keen to reduce the number of coal-fires (not to abolish them altogether), because they cause labour in the home and pollute the atmosphere with smoke.

**An Accident while Breaking Pitch.**—A compensation claim was lately heard at Liverpool, in which an injured workman refused to accept work offered by his late employer, Mr. J. E. C. Lord, tar distiller and pitch manufacturer, of Bootle. The applicant, who had lost one eye, claimed £300. In March last, while breaking lumps of pitch, a piece struck him in the right eye, resulting in permanent blindness of that eye. On his behalf, it was submitted that the applicant had a right to refuse the continuance of employment offered by the respondent, because the danger which had caused the loss of one eye would be increased if he worked there in a half-blinded condition; and the man's doctor had advised him not to try it. For the respondent, it was pointed out that the offered employment would not necessitate work in any so-called dangerous part of the factory. The applicant said the air round the factory was full of chemical fumes to which he would not expose himself again with only one eye; and there was also dust. His Honour Judge Thomas held that the man was partially incapacitated, and that his wage-earning power was decreased to an extent admitted by the respondent—namely, 6s. 9d. a week for life. An award for this amount was made.



THE NEW "BEARSCOT" TWIN GUIDE ROLLERS

R. & J. DEMPSTER, LTD.,
MANCHESTER.

London Office:
34, VICTORIA STREET,
WESTMINSTER, S.W. 1.

## Liberty and Property Defence League.

In the thirty-eighth annual report of the League, attention is called to the fact that less than ten years ago there was a demand that the State should do everything. Now the national cry is for "Hands off" everything which is outside the proper functions of government. The objects for which the League was established, and the principles which it has sought to uphold, are now meeting with general recognition. The loss of self-goverment which the trades and industries of the country suffered during the war, and the terrific burdens of taxes and rates under which the whole community is now groaning, have brought the nation to a realization of the danger and disaster which inevitably follow all forms of over-government. There is now a universal request for a restoration of free conditions in the sphere of social, economic, and industrial activity, for a return to national methods of taxation, and for a policy of rigid economy in the administration of essential public affairs. In Parliament, which should reflect the will of the Nation, the reaction against State Socialism is noteworthy. On the occasions of proceedings on Bills giving further powers of interference with and control of trade and industry, the feeling of both Houses against any further encroachments upon individual liberty and private enterprise has been so emphatic as to secure either the abandonment or the rejection of the Bills or such amendments as to render their provisions comparatively innocuous. Times have changed. In the altered circumstances of to-day, it is realized that personal freedom and the rights of property must be maintained inviolate, if the progress of civilization is to continue, and national development is not to be checked. The taxpayers refuse any longer to be fleeced in order to further the fads and follies of legislative fussers.

**Bolton District Threatened Strike.**—The threatened strike of gas-workers at Bolton, Bury, Radcliffe, Farnworth, Leigh, Atherton, and Mossley, to which reference has already been made in the "JOURNAL," has been postponed, so that the notices will expire on Feb. 2; the Union having agreed to ballot the members as to whether or not they should accept the zoning and grading scheme of the Manchester Regional Council.

**Traders and Railway Pilferage.**—At a meeting of the Halifax Chamber of Commerce, in the course of a discussion on railway inefficiency, pilferage, &c., Mr. H. Campbell, of the Campbell Gas Engineering Company, said some of his firm's material—and not light stuff, which could readily be missed—had been lost for eighteen months. As the goods could not be found, they were replaced by the firm; and after waiting another year, and having no settlement, the firm deducted their claim from an account of the railway. The latter retaliated by threatening to withdraw the Campbell Company's monthly account. He entirely approved of the course suggested by a member of the chamber, who said his firm listed their consignments weekly, advising the railway companies that the goods were not yet to hand, with a request to prove delivery. If every trade adopted this attitude, the trouble caused to the railway companies would be such that they would be very glad to come to some other arrangement.

**Where the Gas-Cooker is Universal.**—In a letter to the "Manchester Guardian" on the "Smoke Problem," Dr. C. W. Saleeby says that the gas-cooker is universal in the United States and Canada, installed by the landlord as one of his fixtures, and used without payment of hire for it. The only exception he found to this rule was in the City of Buffalo, near Niagara Falls, where electricity is obtainable almost for nothing, thanks to that mighty source of water-power, and where people accordingly cook and do everything else by this means. This, he goes on, is exactly the "exception that proves the rule." We have no Niagara; and the conversion of our coal, which is our all, into electricity by the raising of steam is excessively wasteful. As a general national method, we cannot afford it. For us, with our soft coal, the only economic course is to distil our coal and burn the residues—coke and gas—which, so to say, are "only fit to burn" after the chemist has taken its rarer treasures from this marvellous heritage of ours.

**Radcliffe Joint Gas Board Proposal.**—The rejection by a meeting of Whitefield ratepayers of the proposal for the district to be associated with others in the promotion of a Bill in Parliament for sanction to the transfer of the undertaking of the Radcliffe and Pilkington Gas Company to a Joint Gas Board, is not regarded as a correct expression of the views of the electors generally; and the Chairman of the Urban District Council has received a requisition for a poll to be taken. This request he conveyed to his colleagues at a special meeting; and they unanimously endorsed it. A poll will therefore take place on the 29th inst. Prestwich District has apparently dropped out of the scheme altogether, as the ratepayers' meeting rejected the proposal, and there was a failure to secure the requisite "absolute majority" of the members of the Council in confirmation of a resolution to be associated with the other authorities. The Heywood Corporation have objected to certain clauses in the Bill, and have decided to lodge a petition against it.

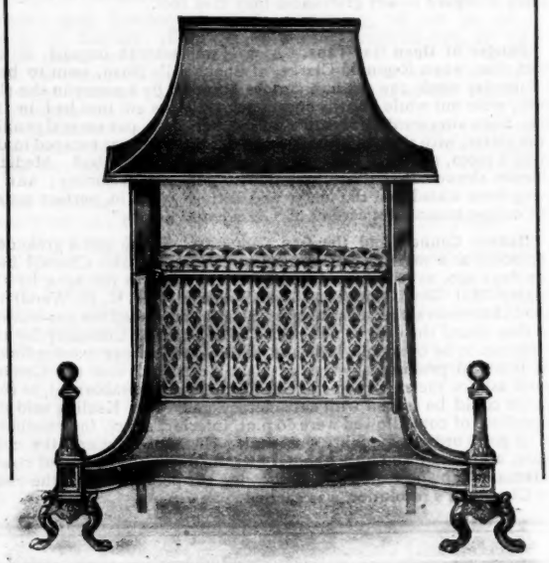
**A Claim for Flooding a Mine.**—Mr. Justice Lawrence, presiding over the War Compensation Court, has been engaged in hearing a claim by the Leeds Fire-Clay Company, Ltd., in respect of the loss through flooding of a coal and clay mine at Harehills. It was alleged that the loss was due to the interference of the Board of Trade in the Company's business. Mr. W. J. Disturnal, K.C., explained that during the strike in the Yorkshire coalfield in July, 1919, men in charge of the pump at the mine were withdrawn by the miners, and the colliery was picketed. Though unattended, the pump worked for eight days. It was first restarted by naval ratings, who entered the mine at great risk, but could not ensure its continuous working because of the dangerous atmosphere of the mine. The financial position of the mine was not guaranteed by the Government, though they controlled the mine's affairs. The contention of the claimants was that the Board of Trade's interference consisted of refusing to accede to the owners' and miners' request that 14·3 p.ct. increase in wages be paid, instead of the Sankey recommendation of 10 p.ct. It was urged that, had the increased percentage been approved, there would have been no strike, and no flooding of the mine.

RICHMOND'S

"Empire"

Gasfire.

A new "Period" design for 1921.



The "Empire" worthily maintains the high efficiency, elegance of design and finish which characterize the whole of Richmond's "Period" series of Gas-fires.

**It embodies the high canopy, combined with the ledge principle which renders it completely proof against the stringent "Lancet" tests, and is equally suitable for placing in an open tiled fireplace or against a tiled slab. The fender is nickel-plated and reflects the cheerful glow of the fire.**

All wearing parts are interchangeable with any "Period" Fire of a similar size.

Ready for Immediate delivery.

THE RICHMOND

GAS STOVE & METER CO., Ltd.

WARRINGTON —— and —— LONDON

**Double Fatality at Notting Hill.**—A verdict of "Accidental death" was returned at an inquest on the bodies of Mrs. Violet Nicholson and her daughter Ivy, of Blenheim Crescent, Notting Hill, who died from coal gas poisoning. Their room was found full of gas, which had leaked through a crack in the bracket; but the burner was still alight. The Coroner said it was extraordinary an explosion had not occurred.

**Wellington (Salop) Gas-Works Fatality.**—An inquest was held at Wellington (Salop) Cottage Hospital last Thursday week, concerning the death of a single man named William Moyden, who died as a result of burns caused by his walking into a vat of hot liquid in the darkness at the Wellington Gas-Works. Mr. Arthur Wolfe (H.M. Inspector of Factories) attended the inquiry. Evidence was given that Moyden was going to an outbuilding at the time, and should not have gone in the direction of the vat, on which there were usually placed two planks. Dr. Ross attributed death to pneumonia, accelerated by injuries received by falling into the hot liquid. The Coroner returned a verdict in accordance with the medical evidence.

**Peterborough Gas Supply.**—Complaints were forthcoming at the last meeting of the Peterborough City Council as to the indifferent quality and pressure of the gas supply; a communication being read from Mr. Rowell, asking the Corporation to put into force the powers they possess to ensure that customers secure gas of sufficient lighting and heating power, as laid down by the statute. Mr. Fletcher proposed that the Council should appoint a gas examiner; and it was suggested that Mr. Elborne (the City Analyst) would undertake the duty, if asked to do so. Mr. Riseley: There may be many complaints about the gas; but for mercy's sake do not let us talk about appointing another official. Alderman Redhead declared that the Gas Company were not to blame in the matter. The gas was already being tested by Government officials; and periodical reports had to be made. The Government sent men down to see whether the gas was all right; and people had no idea of the extent to which they were under the thumb of these authorities. A Committee was appointed to go into the matter, and report.

## STOCK MARKET REPORT.

THE course of things on the Stock Exchange last week was almost a counterpart of its predecessor. The high-class investment category had an excellent time, and attracted all the capital which, in happier circumstances of the trade of the country, would have gone into industrial and other members of the Miscellaneous Market. The extent of the demand powerfully promoted a remarkable advance in prices.

Home Government issues showed extraordinary strength, notwithstanding a mild attack of profit snatching towards the close. Friday's figures for the big four showed large advances—viz., Consols 47⅜-48¼, War Loan 85 7/16-86¼, Funding 69⅞-70¾, Victory 75⅛-76. Everything else participated more or less. Bonds, Corporations, and Indian loans were distinctly better. Home Rails did not attract much attention. Grand Trunks advanced; but Argentines were dull.

The Foreign Market was in good case. French made a welcome recovery, and Argentines, Brazilian, and Japanese showed some advance.

The Miscellaneous Market, as indicated above, was quite under a cloud, and firm points were few and far between.

Business in the Gas Market was more active, and the general tendency was good. Changes of quotation were very few; but all were in the upward direction. The London Companies were strong and steady; a rise in Gas Light debenture being the only move. South Metropolitan was done at 66, in view of a rise in the dividend. All three Sheffields advanced. Imperial Continental touched 126, and the quotation rose 2. Primitiva came once more into notice; business in the preference being extremely brisk. Both ordinary and preference advanced their quotations.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 56½, 57¼, 57½, 58, ditto 10 p.ct. Bonds 131, 132, Imperial Continental 123, 123¼, 123½, 123⅝, 124⅛, Primitiva 9s. 6d., 10s. 4½d., 10s. 6d., ditto preference 22s. 6d., South Metropolitan 63½, 64, 64⅛, 64⅜, 65½, ditto debenture 46, South Suburban 58½. On Tuesday, Alliance and Dublin 40, 40½, Bournemouth "B" 8⅞, 9, European 6, Gas Light ordinary 57, 57¼, 57⅜, 58, Imperial Continental 124½, 124⅝, 125, 125½, 125⅝, 126, ditto debenture 93, Primitiva preference 22s. 6d., South Metropolitan 64. On Wednesday, British 21⅜, Gas Light ordinary 57, 57⅝, ditto preference 56⅜, ditto debenture 46½, 47½, Imperial Continental 124, 124⅛, 125, 125¼, 125½, 125⅜, ditto debenture 92, 92½, Primitiva preference 23s. 6d., 24s., South Metropolitan 64½. On Thursday, Brentford debenture 59, British 21½, 21⅜, Gas Light ordinary 56½, 57, ditto preference 56⅜, Imperial Continental 125, 125¼, 125⅜, ditto debenture 93, Primitiva preference 23s. 9d., 25s., 26s., 27s., 27s. 6d., 30s., South Metropolitan 64½, 65, 65¼, 65½, 66, Bath Consolidated ordinary 64¼. On Friday, Bombay 4, Brentford debenture 58½, Commercial 4 p.ct. 53½, Gas Light ordinary 56½, 56⅝, 57, 57¼, 57½, ditto debenture 48, Imperial Continental 124½, 125½, Primitiva 13s. 6d., 15s., ditto preference 31s. 3d., 32s. 6d., 32s. 9d., 33s. 9d., 34s. 3d., 34s. 4½d., 35s., 35s. 3d., 35s. 7½d., South Metropolitan 65, 65½.

In the Money Market, there was a good, steady demand, not too excessive, which lasted until near the close of the week, when it began to relax. Discount shaped similarly; but business was not very active. Silver varied daily, prices being fractionally above or below 40d. The Bank rate is 7 p.ct., fixed on April 17 last.

### ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

| Issue. | Share. | When ex-Dividend. | Ante-War Dividend & Bonus. | Last Dividend. | NAME. | Closing Prices, July 30, 1914. | Present Prices. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | | |
| 182,049 | Stk. | Aug. 27 | 4 | 4% | Aldershot 4 p.c. Pref. | ... | 56—61 | ... |
| 1,551,868 | ,, | Oct. 14 | 2½ | 3⅛% | Alliance & Dublin Ord. | 59—64 | 38—43 | 40—40½ |
| 374,000 | ,, | Jan. 13 | 4 | 4% | Do. 4 p.c. Deb. | 76—79 | 47—52* | ... |
| 280,000 | 5 | Oct. 28 | 7½ | 8% | Bombay, Ltd. | 5¼—6¼ | 4—4½ | 4 |
| 100,000 | 5 | Aug. 12 | 16 | 5% | Bournemouth Gas and Water { 5 p.c. | .. | 8—9 | ... |
| 383,110 | 10 | ,, | 7 | 7% | Bournemouth Gas and Water { B 7 p.c. | 15—15½ | 8½—9½ | 8⅝—9 |
| 115,000 | 10 | ,, | 6 | 6/- | Bournemouth Gas and Water { Pref. 6 p.c. | 13½—14 | 7½—8½ | ... |
| 162,065 | — | Dec. 30 | — | 4% | Bournemouth Gas and Water { 4 p.c. Deb. | ... | 55—60 | ... |
| 992,045 | Stk. | July 14 | 14 | 30/- | Brentford A Consolid. | 261—266 | 50—55 | ... |
| 734,920 | ,, | ,, | 11 | 26/3 | Do. B New | 204—209 | 47—52 | ... |
| 55,000 | ,, | ,, | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 68—73 | ... |
| 221,400 | ,, | Dec. 15 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 58—60 | 58½—59 |
| 214,775 | ,, | Aug. 27 | 11 | 7½% | Brighton & Hove Orig. | 208—213 | 100—110 | .. |
| 244,200 | ,, | ,, | 8 | 5½% | Do. A Ord. Stk. | 134—139 | 75—85 | ... |
| 1,287,500 | Stk. | July 29 | 5 | 5% | Bristol 5 p.c. max. | ... | ... | ... |
| 530,000 | 20 | Sept. 15 | 12½ | 10% | British | 44—45 | 20—22 | 21⅛—21⅜ |
| 120,000 | Stk. | Dec. 30 | 4 | 4% | Do. 4 p.c. Deb. Stk. | 88—90 | 55—57 | .. |
| 245,771 | ,, | ,, | 4 | 4% | Buenos Aires 4 p.c. Deb. | 85—87 | 37—40 | ... |
| 100,000 | 10 | May 27 | — | — | Cape Town & Dis., Ltd. | 1½—2½ | 7—7½ | ... |
| 100,000 | 10 | Dec. 10 | — | 4½% | Do. 4½ p.c. Pref. | 4—6 | 5—6 | ... |
| 100,000 | Stk. | Dec. 30 | 4½ | 4½% | Do. 4½ p.c. Deb. Stk. | 70—75 | 54—59 | .. |
| 157,150 | ,, | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. | 108—110 | ... | . |
| 1,513,280 | ,, | Aug. 12 | 5/9/4 | 30/- | Commercial 4 p.c. Stk. | 106—108 | 53—56 | 53½ |
| 560,000 | ,, | ,, | 5½ | 26/3 | Do. 3½ p.c. do. | 103—105 | 47—52 | ... |
| 475,000 | ,, | Dec. 15 | 3 | 3% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 42—45 | ... |
| 800,000 | ,, | Dec. 11 | 4 | — | Continental Union Ltd. | 76—79 | 25—30 | ... |
| 200,000 | ,, | ,, | 7 | — | Do. 7 p.c. Pref. | 115—118 | 40—50 | ... |
| $1,600 | ,, | Aug. 27 | 14½ | 10½% | Croydon A 10 p.c. | ... | 125—135 | ... |
| 278,400 | — | ,, | 11½ | 7½% | Croydon B and C 7 p.c. | .. | 90—100 | ... |
| 492,270 | Stk. | — | 6 | 5% | Derby Con. Stk. | 123—125 | ... | ... |
| 55,000 | ,, | — | 4 | 4% | Do. Deb. Stk. | 102—104 | ... | ... |
| 1,002,180 | 10 | Jan. 29 | 10 | 5/0 | European, Ltd. | 17½—18 | 5½—6½ | 6 |
| 16,298,975 | Stk. | July 29 | 4/17/4 | 30/- | Gas Light and Coke { 4 p.c. Ord. | 98—102 | 56—59 | 56½—58 |
| 2,600,000 | ,, | ,, | 3½ | 26/3 | Gas Light and Coke { 3½ p.c. max. | 76—79 | 36—39 | .. |
| 4,062,235 | ,, | ,, | 4 | 4% | Gas Light and Coke { 4 p.c. Con. Pref. | 96—99 | 55—58 | 56¾ |
| 4,674,850 | ,, | Dec. 15 | 3 | 3% | Gas Light and Coke { 3 p.c. Con. Deb. | 72½—74½ | 45—48 | 46½—48 |
| 130,000 | ,, | Dec. 11 | 10 | 10% | Gas Light and Coke { 10 p.c. Bonds. | ... | ... | 131—132 |
| 82,500 | ,, | Sept. 15 | 5 | 3½% | Hastings & St. L. 5 p.c. | ... | 53—58 | ... |
| 258,740 | ,, | ,, | 3½ | 2½% | Do. 3½ p.c. | 87—89 | 37—39 | ... |
| 70,000 | 10 | May 13 | 11 | 8% | Hongkong & China, Ltd. | 16½—16¾ | 8½—9½ | ... |
| 86,600 | Stk. | Sept. 15 | 9 | 5½% | Hornsey 7 p.c. | ... | 87—89 | ... |
| 131,000 | ,, | Aug. 12 | 7½ | 4½% | Ilford A and C | 151—154 | 79—84 | ... |
| 65,780 | ,, | ,, | 6½ | 3½% | Do. B | 115—118 | 57—62 | ... |
| 65,500 | ,, | Dec. 30 | 4 | 4% | Do. 4 p.c. Deb. | 92—94 | 54—56 | ... |
| 4,940,000 | ,, | ,, | 9 | 4½% | Imperial Continental | 150—160 | 123—128 | 123—126 |
| 1,235,000 | ,, | Aug. 12 | 3½ | 3½% | Do. 3½ p.c. Deb. Red. | 84—86 | 90—95 | 92—93 |
| 235,242 | ,, | Sept. 15 | 6½ | 5% | Lea Bridge Ord. 5 p.c. | 119—121 | 80—85 | ... |
| 2,498,905 | ,, | Feb. 26 | 10 | 37/6 | Liverpool 5 p.c. Ord. { A. | 211—213 | ... | ... |
| | | | | | Liverpool 5 p.c. Ord. { B. | 146—146 | | ... |
| 306,083 | ,, | June 26 | 4 | 4% | Do. 4 p.c. Pr. Deb. Stk. | ... | ... | ... |
| 165,736 | ,, | Aug. 12 | 7/5/6 | 3½% | Maidstone 5 p.c. | ... | 52—57 | ... |
| 73,000 | 5 | June 11 | 6 | 3% | Malta & Mediterranean | 4½—4¾ | 1¾—2¼ | ... |
| 250,000 | 100 | Oct. 1 | 4½ | 4½% | Met. of Melbourne { 4½ p.c. Deb. | 99—101 | 86—93 | ... |
| 541,920 | Stk. | Nov. 26 | 4 | 6% | Monte Video, Ltd. | 11½—12 | 68—73 | ... |
| 1,875,892 | ,, | July 29 | 4½ | 3½% | Newcastle & Gatsh'dCon. | 98½—99½ | 60—61 | ... |
| 529,705 | ,, | Dec. 30 | 3½ | 3½% | Do. 3½ p.c. Deb. | 82—83 | 49—50 | ... |
| 15,000 | 10 | Sept. 15 | — | 8% | North Middlesex 10 p.c. | ... | 12½—13½ | .. |
| 55,940 | 10 | ,, | 7/14/0 | 5⅝% | ,, ,, 7 p.c. | 14—15 | 7—7½ | ... |
| 300,000 | Stk. | Nov. 26 | 8 | 8% | Oriental, Ltd. | 117—122 | 93—98 | ... |
| 60,000 | 5 | Mar. 26 | 10 | 1/- | Ottoman, Ltd. | 2½—2¾ | 2—3 | ... |
| 60,000 | 50 | Aug. 27 | 13 | 7½% | Portsea Island, B | 128—131 | 65—70 | ... |
| 100,000 | 50 | ,, | 12 | 6½% | Do. C | 118—121 | 50—55 | ... |
| 249,980 | 5 | April 29 | 8 | — | Primitiva Ord. | 5¼—6 | ⅛—⅜ | 9/6—15/- |
| 499,960 | 5 | June 26 | 5 | — | Do. 5 p.c. Pref. | 4⅞—5 | 1⅛—1⅜ | 22/6—35/7½ |
| 521,600 | 100 | Dec. 1 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 67—69 | ... |
| 600,000 | Stk. | July 29 | 4 | 4% | Do. ,, ,, 1911 | ... | 40—42 | ... |
| 346,198 | ,, | Dec. 30 | 4 | 4% | River Plate 4 p.c. Deb. | 85—87 | 35—39 | ... |
| 150,000 | 10 | Sept. 30 | 6 | 6/- | San Paulo { 6 p.c. Pref. | 10½—11 | 6¼—7¼ | ... |
| 125,000 | 50 | Jan. 3 | 5 | 5% | San Paulo { 5 p.c. Deb. | 47—49 | 37—39 | ... |
| 135,000 | Stk. | Aug. 27 | 10 | 5% | Sheffield A | 223—224 | 62—65 | ... |
| 209,984 | ,, | ,, | 10 | 4% | Do. B | 222—224 | 60—62 | ... |
| 523,500 | ,, | ,, | 10 | 3½% | Do. C | 220—222 | 57—60 | ... |
| 133,201 | Stk. | Sept. 15 | 4 | 4% | Shrewsbury 5 p.c. | ... | ... | ... |
| 90,000 | 10 | Sept. 30 | 9 | 9% | South African | 10½—11½ | 10½—11½ | ... |
| 6,609,895 | Stk. | Aug. 12 | 5/4/0 | 5%† | South Met. Ord. | 111—113 | 63—66 | 63½—66 |
| 250,000 | ,, | Jan. 13 | — | 5% | Do. Red. Pref. | ... | 90—92* | .. |
| 1,895,445 | ,, | ,, | 3 | 3% | Do. 3 p.c. Deb. | 72½—74½ | 45—46* | 46 |
| 224,820 | ,, | Aug. 27 | 8½ | 3% | South Shields Con. Stk. | 157—159 | 95—96 | ... |
| 1,087,795 | ,, | July 29 | 6 | 3½% | S'th Suburb'n Ord. 5 p.c. | 114—116 | 56—61 | ... |
| 247,558 | ,, | Dec. 30 | 5 | 5% | Do. 5 p.c. Deb. Stk. | 116—118 | 65—70 | ... |
| 647,740 | ,, | Nov. 12 | 7½ | 3½% | Southampton Ord. | 99—102 | 55—58 | ... |
| 121,275 | ,, | Dec. 30 | 4 | 4% | Do. 4 p.c. Deb. Stk. | ... | 57—59 | ... |
| 120,000 | ,, | Aug. 12 | — | 3½% | Tottenham { A 5 p.c. | 135—138 | 60—65 | ... |
| 782,275 | ,, | ,, | 6 | 2½% | Tottenham { B 3½ p.c. | 115—117 | 50—55 | ... |
| 181,255 | ,, | Dec. 15 | 4 | 4% | Tottenham { 4 p.c. Deb. | 87—89 | 55—58 | ... |
| 182,380 | 10 | Dec. 30 | 5 | — | Tuscan, Ltd. | 5—6 | 1—2 | ... |
| 149,900 | 10 | July 1 | 5 | 5% | Do. 5 p.c. Deb. Red. | 93—95 | 45—50 | ... |
| 236,476 | Stk. | Sept. 15 | 5 | 3½% | Tynemouth 5 p.c. max. | 108½—109 | 69—71 | ... |
| | | | | | Wandsworth, Wimbledon, and Epsom— | | | |
| 30,000 | ,, | Aug. 27 | 8½ | 47/6 | Wandsworth A 5 p.c. | 151—156 | 75—80 | ... |
| 255,636 | ,, | ,, | 6½ | 32/6 | Do. B 3½ p.c. | 129—134 | 53—58 | ... |
| 108,075 | ,, | ,, | — | 33/3 | Do. C | ... | 50—55 | ... |
| 140,863 | ,, | ,, | — | 33/3 | New Ordinary | ... | 50—55 | ... |
| 352,000 | ,, | ,, | 6½ | 26/3 | Wimbledon 5 p.c. | 117—122 | 43—48 | ... |
| 98,000 | ,, | ,, | 6½ | 32/6 | Epsom 5 p.c. | 121—126 | 50—55 | ... |
| £8,416 | ,, | Dec. 30 | 3 | 3% | 3 p.c. Deb. Stk. | 66—69 | 43—45 | ... |

* Ex Div. † Next dividend will be at this rate.

**A Challenge to Eliminate Black Smoke.**—Some days ago, Sir William Hopwood, of Shaw, challenged the District Council and the Medical Officer of Health (Dr. A. V. Davies) to eliminate the black smoke nuisance at one of his mills, and offered to bear all the expense of the necessary changes and work involved. Dr. Davies accepted the challenge, and stated that he was prepared to commence the work immediately. Sir William Hopwood's offer was prompted by a statement made by Dr. Saleeby during a lecture, to the effect that the atmosphere of Shaw was unfit to live in from pollution by smoke.

**Subsidence near Elland.**—A serious landslide on the main road between Brighouse and Elland (a portion of the road having dropped several inches, and created gaping holes some yards in extent) has laid bare a portion of the mains belonging to the Elland-cum-Greetland Gas Company; and these mains are having to be guarded. Owing to the subsidence, the mains are inches above the level of the road. The subsidence has become more serious; and there are prospects of the collapse of the whole hillside, unless very quick and effective action is taken by the highway authorities. Mr. Robert Porter (the Engineer and Manager to the Gas Company) puts the blame on the West Riding County Council, who, he says, have dallied for years with the question of woodland drainage, the faultiness of which is believed to be the cause of the land subsidence. Mr. Porter says that already in this part the Company have had to replace mains three times, and to lift them 2 ft. on each occasion.

**The Therm Charge Question at Derby.**—Mr. Surtees, at the last meeting of the Derby Town Council, raised the question as to what steps had been taken to safeguard the Corporation and gas consumers in connection with the application of the Derby Gas Company to the Board of Trade for an Order providing for the substitution of the power to charge for thermal units instead of being under the statutory requirement that they should supply gas of any particular illuminating value, and the substitution for the standard prices per thousand cubic feet now authorized of standard prices per therm. Mr. Domleo explained that the Corporation were represented with other local authorities in Parliament and in the Committee Rooms of the House of Commons when the Gas Regulation Act of 1920 was passed. The Corporation paid a share of the cost of expert representation; and they were now engaging an expert to report upon the matter, if necessary, before the objections were laid before the Board of Trade. The Derby Gas Company were only moving along lines suggested by the Board of Trade; and in the course of two years every gas undertaking in the country would change from the candle power standard to one of heat. The Corporation and the gas consumers could take it for granted that their interests were being carefully looked after.

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In Letterkenny (co. Donegal), the price of gas is 20s. per 1000 c.ft.

The Bellshill Gas Company, Ltd., Lanarkshire, has been purchased by the County Council for the sum of £52,000.

The necessary resolutions have been passed for the voluntary winding-up of the Convex Incandescent Mantle Company, Ltd.

Malton, in Yorkshire, a town which has adopted electric light very largely, suffered inconvenience for several hours last week by a failure of the supply of current.

An official list of the latest joint-stock companies to be struck off the register includes the names of the Coke-Ovens and Bye-Products Company, and Invetrol Lighting.

Damage to the extent of about £100 was caused by fire at the chemical and coke-oven plant at Parkgate, near Rotherham. Two cooling tanks of tar were set alight by a spark.

The Brynna Gas Coal Collieries, Ltd., is being wound-up voluntarily, for the purpose of reconstruction. Mr. David Roberts, of No. 61, Wind Street, Swansea, is the Liquidator.

The Mayor (Captain G. H. Newton), on Wednesday last, formally started the new vertical retort plant at the Ripon Corporation Gas-Works. There were present a large number of past and present members of the City Council.

The Lochgelly Gas Company have been granted permission to erect vertical retorts. Plans have been under discussion for eighteen months; and the Company had the question at issue with the local Dean of Guild Court referred to the Edinburgh Law Courts.

Attention was drawn by the Provost, at a meeting of the Galashiels Town Council, to the inadequate street lighting, and the poor quality of the gas supplied. A system of automatic lighting is to be installed; and the Town Clerk stated that Messrs. Alder and Mackay were ready to proceed with the work.

Owing to a fault in the main generator at Doncaster electricity works, one day last week, the tramcars were brought to a standstill, and houses and business places dependent on electric light or power were plunged in darkness and machinery stopped. Being market day, the occurrence was particularly unfortunate for shopkeepers.

A verdict of "Accidental death" was returned at an inquest, last Thursday, at Eastburn, near Keighley, on the body of John Gill, a farmer and joiner, who was killed as a result of his clothes being drawn into the revolving shaft of a gas-engine. The man was strangled. It is assumed that the accident must have occurred while he was starting or overhauling the engine.

A report presented last week to the Bradford Gas Committee by Mr. Charles Wood (the Gas Engineer) stated that during the past fortnight 124 additional street-lamps had been put into work, leaving 2034 still to be re-fitted after war-time disuse. The report mentioned that the Bradford Gas Department have among their employees 338 ex-service men, of whom 68 are partially disabled.

At a Girvan Town Council meeting, Mr. Conway moved the appointment of a Committee to consider the price and quality of the gas supplied by the Company. He stated he did not want to blame the Gas Manager. On the contrary, he sympathized with him. He believed that the present plant was not sufficient to meet the demands of a growing population. The Provost (who is the Chairman of the Gas Company) said the Directors had given the subject their serious attention; and there would be an improvement soon. It was remitted to a small Committee to go into the whole question.

At an inquest which took place at West Leigh, on the body of John Boardman, who was electrocuted at Abram, the Deputy Coroner remarked that deceased had evidently a desire to further his employers' interests, but had not realized the danger of what he was doing. It appeared that, while passing along the colliery railway line, he saw an electric cable fusing, and setting fire to one of the poles. Boardman went over the hedge; and a few minutes later a companion heard a scream, and saw flames shoot into the air. On investigation, Boardman was found unconscious; and he died three minutes later. The fingers of his left hand were almost burnt through. A verdict of "Death from misadventure" was returned.

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